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Reverse-Thrust Propellers as Landing Brakes
Jack H. Sheets and Gordon W. MacKinney

Chemistry and Prevention of Piston-Ring Sticking
G. H. Denison, Jr. and J. O. Clayton

Testing Heavy-Duty Oils for Navy — Lt.-Com. A. D. Brabbs

New Aspects of Airline Aircraft Maintenance — Reagan C. Stunkel

Greases for Military Vehicles — Major N. W. Faust

Engine Performance with Low-Cetane-Fuels — L. W. Griffith and R. C. Williams

Trucks as of 19— — B. B. Bachman

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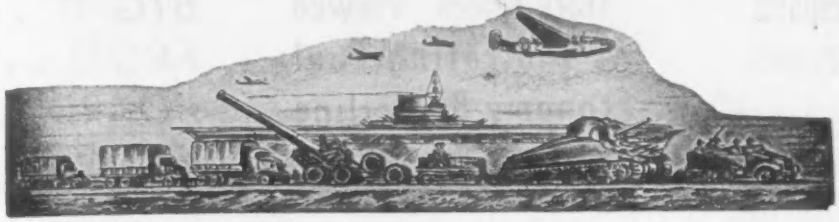

News of the **JUNE** *Issue*

By Norman G. Shidle

Light from Bushels

MOST men try to make themselves look good when seeking a job. Few continue the process as part of their daily work.

Doing a good job is the basis for most personal advancement – but recognition of the "doing" by others is equally essential.

There can be no fixed formula for shining the right amount of light from beneath one's bushel. The object is to attract attention without creating obnoxious glare. Many men plug along for years, doing assigned tasks capably and efficiently, yet so quietly that no one realizes their worth until they die. Others talk themselves out of job after job.

Selected editorials by Mr. Shidle have been published under the title, "For the Sake of Argument."

This book is available to SAE members at 50¢, to non-members at $1, from Special Publications Department, Society of Automotive Engineers, 29 West 39th St., New York 18.

Positive effort to keep others informed is a practical means of getting results – recognition for most of us. Even the most shy, inarticulate technician can see that process as a normal, necessary part of his job. The anathema word, "salesmanship" need never enter his consciousness.

Inquiries, for instance, can be welcomed as opportunities . . . chances to tell outsiders about what we are doing. The associate who stops to ask a question can be taken on a *brief* fact-and-idea tour of recent goings-on in our domain. He will ask more questions if he gets interest-provoking answers. He will particularly enjoy getting *our* story in terms of *his* interests.

Those who don't stop to ask questions can be encouraged to more detailed concern by casual comments about our work injected into otherwise routine business contacts.

Keeping others informed is a necessary part of almost every job. Keeping them interested helps them to help us.

Knock-Free Fuels Reveal New Power Possibilities

AUTOMOTIVE engineers who can indulge in the luxury of philosophical contemplation have a potent subject for consideration – future possibilities of the internal-combustion engine operating on knock-free fuel.

This subject rolls from the tongue somewhat less trippingly than the currently blithe predictions concerning gas turbines and jet propulsion. Yet it is basic, and worth pondering even beyond the thought that the ubiquitously used, and damned, internal-combustion engine has a new and additional freedom – from the limitations of knocking.

That one fact can make all the difference in the world. "Differences" probably is more accurate. If greater power, efficiency, and economy become additional attributes of the internal-combustion engine, the changes in social thinking and doing which that machine already has wrought are likely to be multiplied.

Billions of Horsepower

Pre-war, the power produced by automobile engines alone was estimated to be 30 times the output of all central power generating stations. Horsepower of the war-plane engines currently produced in a single month is estimated to be 10 times that of Boulder Dam powerplants. Such estimates lead quickly to the billion bracket – and a billion horsepower is something with which to do more than conjure.

Inspiration to such philosophizing will be C. F. Kettering's article in June *SAE Journal* on the new tailor-made fuel, trimethyl butane, or triptane. Quick grasp of indicated potentialities is facilitated by such findings, to be documented and explained in detail, as:

- Triptane-lead combinations can produce four times the power yielded by 100-octane fuel.
- Reductions on the order of 25% in specific fuel consumption have been obtained.
- Compression ratios can be increased for higher efficiency, or degrees of supercharging can be augmented for higher specific output.

Triptane will be described as one result of rearranging the seven carbon and 16 hydrogen atoms of the heptane molecule in the course of a continuing search for the best combination of engine and fuel productive of the greatest value per dollar. Basic idea of the search was that since the fuel is just as much a part of the engine as piston or valves, the type of engine is less important than getting the most power at the lowest cost from every pound of fuel.

Relative Efficiencies

For those inclined to discount the internal-combustion engine and to exalt the gas turbine and jet propulsion, Mr. Kettering will have some easily digested suggestions. Jet propulsion as used in the German robot bomb V-1, he will indicate, is a modification of the early Lenoir cycle which had a measured thermal efficiency of less than four per cent. Gas turbines are adaptations of the old Brayton cycle, which had a measured thermal efficiency of less than eight per cent. The internal-combustion engine is based upon the Otto cycle, measured thermal efficiency of which was placed at 18% back in 1882.

Further, Mr. Kettering will suggest, none should overlook the key to higher efficiencies contained in the one word "compression," an important principle given new possibilities by the new fuel.

Cold Engines Respond To Immersion Heaters

SIMPLE, practical, and economical method of starting cold engines of motor vehicles by applying heat will be described in June *SAE Journal* by E. P. Gohn, of The Atlantic Refining Co.

The method, which involves the use of electric immersion heaters installed in the block water jacket, will be said to be satisfactory particularly because it heats both the coolant in the water jacket and the lubricant in the crankcase simultaneously.

Mr. Gohn will say that two heaters, one of 500 w, the other of 750, installed on motor vehicles stored outdoors in zero weather, raise water jacket temperatures to around 45 F within two hours and assure starting within seconds.

Important aids to quick and certain starting, he will add, are properly functioning cooling-system thermostats and well-charged batteries.

"Permanent" Grease Is Sought For Aircraft

MAN'S persistent quest for a perpetual-motion machine is being emulated by aeronautical engineers seeking a permanent grease for lubrication purposes.

"Permanent" grease is defined as one which outlasts 500 hr of operation, functions satisfactorily at —50 F, and 250 F, has a "shelf-life" of at least two years, performs equally well regardless of season, resists centrifugal force, and discourages fungus growth.

These, and additional, attributes of satisfactory greases for aircraft will be discussed in June *SAE Journal* by Major S. C. Britton and W. Schlesinger, of Air Technical Service Command. They will report on wartime experience with four standard greases now used.

The Cover

TRUCKS *do their jobs month after month, year after year, in war and in peace. Designs which left engineers' drafting boards 20 years ago vie with youthful prototypes in carrying their share of commerce's load. A few feet from the house in which the fabulous Peter Stuyvesant ruled as the last governor of New Amsterdam, Artist Lili Rethi crystallized for this month's cover a segment of this never-ending service. Near West Street piers, the trucks work on as some of the two billion dollars spent annually for food in New York City changes hands.*

"Trace Knock" Viewed As Indicating Fuel Economy Borderline

CRITICALLY narrow operating margins faithfully reflecting payload economics are forcing airlines and their engineers to keep watchful eyes on fuel consumption. Vagaries of wind and weather render theirs no easy task. The most they can do is to make mechanical conditions favorable for fuel economy and hope for tailwinds to better their best.

There is evidence that a 20% waste of fuel borders upon general practice. This is no wanton waste. Instead, it represents what has come to be regarded as a "margin of protection." On the theory that it is better to be safe than sorry, the engine is put on "full rich" during take-offs, climbs, and other critical operating periods in order to avoid operating difficulties, and worse.

Evidence now is being presented that "full rich" not only wastes fuel, but is no insurance against trouble. Proposal is made that aircraft engines be adjusted to operate nearly at the point of light incipient detonation, or "trace knock."

How fuel economy and operating safety thus can be attained will be revealed, with full documentation, in June *SAE Journal* by Philip J. Costa, of Sperry Gyroscope Co. Mr. Costa will report on flight tests with "trace knock" adjustment maintained by using the M.I.T.-Sperry Detonation Equipment and Sperry "knockometer" for instrumentation.

■ ■

Injection Fueling Undergoing Study

ENGINEERING shortcut to maximum engine performance now intriguing interest is water-alcohol injection. The idea is on the ancient side, antedating the century, but recent successful use with combat aircraft engines has given credence to the idea that motorists might not be merely indulging their imagination when they found automobile engines operating more smoothly on rainy or foggy days.

Proposed use of water-alcohol injection is to provide internal cooling, which discourages detonation. Ultimate objective is the design of higher-compression, lighter-weight, supercharged injection engines producing maximum power from minimum fuels.

By permitting the use of fuels of 10 to 15 octane numbers below those normally required, water-alcohol injection increases engine power and performance, it will be explained in June *SAE Journal* by A. T. Colwell, R. E. Cummings, and D. E. Anderson, of Thompson Products, Inc. They will report that injection also overcomes engine roughness, prevents damage to bearings and rapid wear.

BIG DIVIDENDS FROM DRAFTING BOARD RESEARCH

CONVICTION seems to be growing among materials engineers that the greatest material of all is the paper on the drafting board. Here design and redesign can produce surprising results. Here fixed and new notions alike are put to test, altered and improved, swept away and replaced, at no greater cost and effort than strokes of pencil and eraser.

Such ideas underlie an article on steel as a material to be presented in June *SAE Journal* by E. P. Strothman, of A. O. Smith Corp. Mr. Strothman will hold no particular brief for paper, but will recommend that more cerebration, and use of paper for redesign, temper any temptation to replace steel.

It will be Mr. Strothman's contention that ingenious design and redesign can give low-alloy steels highly desirable qualities, and that reconceived design is likely to prove so much more simple and economical as to warrant the necessary research.

Combine Engines And Turbines For Plane Propulsion

NEW heights of efficiency in aircraft operation have been brought into view by proposals to compound turbines with internal-combustion engines as powerplants. Idea is to gain the advantages both of engine and turbine, plus additional benefits from employing the turbine to consume the waste exhaust gases of the engine.

The scheme may seem to suggest complications, but C. F. Bachle, of Continental Aviation & Engineering Corp., will make it completely clear, and reasonably simple, in June *SAE Journal*. Mr. Bachle will show how any type of gasoline or diesel engine for aircraft can be combined with a turbine to produce results especially good in long-range cruising at 300 mph. For this operation, which requires minimum weight of powerplant plus fuel, Mr. Bachle will rate the gasoline piston engine, compounded with turbine, and propeller as the most efficient, jet propulsion the least. For higher speeds, on the order of 550 mph, which require something like 83% more power, jet propulsion takes the highest rating with long-range operation.

Army Is Seeking Universal Grease

EFFORTS of the Army to find a multi-use gear lubricant of dependable performance will be described in June *SAE Journal* by Paul V. Keyser, of Socony-Vacuum Oil Co., Inc., and director of the CLR Gear Oil Projects.

What the Army really wants, Mr. Keyser will suggest, is something on the order of a universal gear lubricant equally satisfactory for hypoids, other gears, and transmissions

Fuels and Props Top Features

AT METROPOLITAN SECTION AERONAUTIC MEETING

HOPE that post-war wonder fuels will permit greater performance and lower economy in airline operation was discouraged at the Local War Emergency Aeronautic Meeting sponsored by the SAE Metropolitan Section at the Hotel New Yorker April 5 – although brighter prospects were visualized in the field of airplane propeller design. Experiences of a civilian watching the war in the Pacific were recounted at the dinner session.

Active in the operation of this Local War Emergency Meeting were Metropolitan Section Chairman Robert H. Clark, Vice-Chairman R. Dixon Speas, Jack O. Charshafian, vice-chairman for aeronautics, and Kenneth Kasschau, house committee chairman.

Before a capacity audience of over 500 members and guests, discussers at the aircraft-engine session, presided over by A. L. Beall, research engineer, Wright Aeronautical Corp., participated in a three-paper symposium on aircraft fuels.

Debunking the possibilities of super-octane gasoline for domestic aircraft use and branding such fuel as a means of shortening engine life and reducing safety factors, Earle A. Ryder, consulting engineer, Pratt & Whitney Aircraft, rated fuel of 91 octane number to be generally satisfactory. He did not advise the use of more expensive fuels for short-run operations of 750 miles or less. For flights of more than 1500 to 2000 miles non-stop, he declared, savings made possible by high antiknock fuels will begin to pay out and a considerable premium can then be afforded for better gasoline.

Mr. Ryder held income from payloads to be the criterion of fuel values, asserting that the more costly fuels would be permissible only if, by reducing fuel consumption, they simultaneously would allow increases in payload. Characterizing freedom from knocking as essential to fuel quality, the speaker listed other requirements to be low price, non-corrosiveness to metal or rubber, freedom from lead, and the highest possible knock value.

Agreeing that airlines will not be interested in the so-called "super-fuels," Gilbert K. Brower, chief materials engineer, American Airlines, Inc., expressed the opinion that they would rather have a limited number of grades of gasoline which economically would satisfy varying operating needs.

Huge Fuel Consumption Expected

Consumption of gasoline at the rate of 2000 gal a min – equivalent to a tank car every 5 min, or more than 1,000,000,000 gal annually – was predicted for commercial and private aircraft by Mr. Brower. He expects that by 1954 air transport operators alone will be paying more than $70,000,000 yearly for fuels and lubricants. Each penny per gallon change in fuel prices was estimated to make a total cost difference of approximately $5,000,000 annually.

He foresaw the trend of aircraft-engine fuels within the next five to ten years as being grades 91/96 and 100/130 with some possible demand to cover special operating conditions for a grade higher. He likened the publicity given to "super-fuels" as "sentiment akin to Nietszche's philosophy of glorifying the superman . . ." Frankly, the airlines would prefer less ballyhoo and more down-to-earth realistic approach to the development of economical and good quality fuels. "We, assuredly," he said, "are not in the market for 'super-fuels' at premium prices."

New airplanes, he reported, will have their payload determined by the volume capacity of the fuselage.

The third paper at the symposium was on aircraft fuels of the future from the supplier's viewpoint, by Dr. R. T. Goodwin, manager, central aviation department, Shell Oil Co., and was read by T. B. Rendel, technical assistant, same company.

The author declared that fuel suppliers, like airlines operators, want to limit the number of grades of gasoline, and he proposed a maximum of five grades as satisfactory for every type of plane. Suggesting 80 octane for light and medium craft, 91 for regular use, and 92 or 93 octane for special use in commercial planes engaged in main- or feeder-line operations, he recommended the use of 100 octane fuel for military purposes and a possibly higher grade for long-range transoceanic flying.

Regardless of drawbacks, he said, lead as an additive remains the cheapest and most practical way to improve a fuel's antiknock value. Synthetic production of fuels high in antiknock rating now is undergoing large-scale development, he added, but some components of such fuels are not yet commercially economical even when available for use with engines of advanced design. Describing fuel stability as a parallel problem, he reported that wartime experience is extending knowledge, and that post-war fuels will meet requirements for long-time storage.

Although military secrecy precluded any detailed discussion of jet propulsion problems, it was felt that there would be many difficulties attendant upon fueling internal-combustion turbines installed in civil aircraft.

Featured speakers at the propeller session chairmanned by W. J. Blanchard, general

Kenneth Campbell (extreme left) is shown being presented with the Wright Brothers Medal by William Littlewood, chairman of the Board of Awards. This annual award goes to the author of the best paper on aerodynamics or structural theory or research which was delivered at an SAE meeting during the calendar year

manager, Aeroproducts Division, GMC, reported their findings on propeller design based on research studies. John D. Waugh, technical assistant, public relations department, Curtiss-Wright Corp., Propeller Division, advocated the use of automatic or controllable variable pitch propellers on light aircraft, and saw civilian use of private planes on a growing scale in post-war years. A display of two propellers of this type received interested inspection in the reception room.

Mr. Waugh suggested that airframe and engine manufacturers consider the propeller in its initial design, at which time a variable pitch type would almost surely be adopted.

Describing graphically the results of over 10 different tests of variable pitch propellers installed on light airplanes of 65 to 100 hp, the speaker indicated the following benefits: static thrust was increased from 10 to 20% over the fixed pitch type; reduction in take-off run ranged between 30 and 45%, while the increase in the rate of climb was between 10 and 15%; and values for the increase in top speed, when available, were between 10 and 15%. He emphasized also that the equipment contributes to safety, reduces operating costs, and improves plane performance.

Covering a different phase of the same subject, Stanley G. Best, assistant project engineer, Hamilton Standard Propellers Division, clarified some of the problems of propeller unbalance. Proper design of the engine mounts or redesign of parts of the aircraft which exhibit troublesome localized resonant characteristics are positive cures for this defect, he said, although in some cases it is necessary to resort to field balancing of installed propellers.

Studies conducted on a medium bomber convinced Mr. Best that mass force balancing of the vibration of the structure is a much more feasible device than complete force and moment balance.

More than 330 persons attended the dinner, which closed the highly successful one-day meeting of the Section. Metropolitan Chairman Robert H. Clark welcomed the audience, and Toastmaster Alfred Marchev, president, Republic Aviation, introduced the speakers.

Outlining the scope of the automotive program, SAE President James M. Crawford stated that the industry had the divided responsibility of carrying on an unaccustomed share of aircraft, tank and weapon production while designing and producing new military vehicles.

"Aeronautical engineering staffs were divided by supplying us with men to teach their 'know-how' and carrying on a vast program of producing more engines, airplanes and accessories," he said.

He stated that this spirit of cooperation has been a major factor in speeding victory, as well as in bringing about a better understanding of management problems.

Following Mr. Crawford's talk, Kenneth Campbell, senior project engineer, Wright Aeronautical Corp., was awarded the 16th Wright Brothers Medal in recognition of his paper "Engine Cooling Fan Theory and Practice," judged the best treatise on aerodynamics delivered before an SAE meeting in 1944. Presentation was made by William Littlewood, chairman of the Wright Brothers Medal Board of Award and vice-president of engineering, American Airlines, Inc.

Recently returned from a trip to the Pacific Theater of War, P. B. Taylor, vice-president, Wright Aeronautical Corp., and principal speaker of the evening, described his experiences and those of his fellow-traveler, Mr. Marchev, in the areas of Saipan, Guam, Leyte and Tinian. Mr. Taylor, who interspersed his story with amusing and interesting anecdotes of the tour, praised the ability of the flyers to land and take off from airstrips which have to serve as airports at these bases.

Beautifully colored slides shown after his talk provided a vivid pictorial account of the journey and of the planes he saw in action.

Kenneth Campbell Responds . . .

ACCEPTING the Wright Brothers Medal, Kenneth Campbell said in part: I could not accept it with a clear conscience without bringing to your attention my dependence on the friendly support of many other engineers, both within and without my own company, and particularly on the partnership in the venture of cooling-fan development which I have enjoyed for many years with my colleague and friend, Allan Chilton; he believed early in fans and ever since has been solely responsible for the design of geared fan drives for a number of experimental engine models.

I should like also to emphasize how lucky we are that our helpers in *all* categories feel they have a personal stake in any new project. One Saturday night last July, we were struggling to complete a test on a fan and its drive for shipment to the NACA wind tunnel. It was already a week overdue and about to lose its place. About midnight, the electrical detector indicated the arrival of chips in the engine oil sump, presumably from the new parts still under development. This normally calls for protective removal and tear down of the engine, in this case spelling failure. However, inspection of the size and quantity of the chips might warrant taking a chance that they were only residue from a previous test and the present development perfectly satisfactory. The first inspection paid off, and the test was resumed. Later on during the night, chips again appeared and the procedure was followed all over again. The test was resumed and a third time before morning the same thing occurred, but the test objective was reached and the parts were shipped.

Now, half the people in this room know that draining the sump is an awfully routine procedure in experimental testing, but doing it three times in a night on a rush basis is not. It calls each time for disposing of about two buckets of scalding oil 15 ft up in the air, besides "buttoning" everything all up again. The tester who eagerly did it, Phil O'Hara by name, was obviously anxious to see the project a success. We theorists, researchers, and designers are indebted to the Phil O'Haras scattered throughout all our plants, without whose equal desire for the success of our projects there would be no contribution in the engineering sense that theory must be consummated in terms of successful practice.

So, in accepting this honor, I take the most pride of all in the thought that my part here is perhaps that of a fitting representative of the many enthusiastic supporters whose work built up the published knowledge for which the Wright Brothers Medal is awarded this year.

News..

..OF THE SOCIETY

Aircraft Accessory Parts Packaging Project Began at Services' Request

UPON the request of the Working Committee of the Army-Navy Aeronautical Board, the Society's Aircraft Accessories Subdivision has launched a comprehensive program on preservation and packaging of spare parts for accessories, propellers, and instruments.

The new committee, headed by Paul J. Kondla, Pratt & Whitney Aircraft, is composed of chairmen of 16 subcommittees. This group, known as Committee A-13, will serve as a steering and coordinating committee.

A major part of the task has already been completed, it was reported at a recent meeting, when a study of the list of spare parts purchased by the Army and Navy was analyzed to determine how they should be preserved and packaged to be most beneficial for use at advance depots.

The first group, A-13-A, on the Packaging of Bearings, started its work last November under the chairmanship of L. A. Danse, General Motors Corp. Their work, in conjunction with the services, has helped to decrease bearing losses due to corrosion.

Early this year the 16 A-13 subcommittees held a two-day meeting with the Army and Navy packaging experts to review the requirements for preparing ANA packaging lists.

Each of the subcommittees was assigned specific work both in preparing a list of parts, and to recommend the best method of packaging the parts shown in this list. This would include preservative and type of container to be used. These individual lists will later be combined into a master list.

The following subcommittees have already met and have prepared master lists for the preservation and packaging of spare parts peculiar to their particular units: Pumps and valves; magnetos; propellers; radio shielding; turrets; starters, generators, and regulators; instruments, and navigational instruments.

There is a movement among some Government circles toward having overall standards and specifications where possible to avoid the cost and confusion of numerous specifications issued by various Government contracting agencies for the same material or process. It was pointed out that these proposed specifications would allow the Ordnance Department, Signal Corps, Corps of Engineers, and other Army and Navy divisions to package similar parts to one specification. Even if the packaging in some cases would be somewhat costlier for the less exacting Government agencies than at present, industry spokesmen indicated that there would be a saving of costs in the long run because they would not be called upon to package identical products under several procedures.

The following chairmen of subcommittees have been appointed by Mr. Kondla, and will also serve as members of his Committee A-13: A, Bearings, L. A. Danse, General Motors Corp.; B, Pumps & Valves, H. A. Lockwood, Chandler-Evans Corp.; C, Magnetos, L. J. Weber, General Electric Co.; D, Propellers, R. P. Lambeck, Hamilton Standard Propellers; E, Carburetors, H. D. Stolcenburg, Bendix Products Division; F, Radio Shielding, A. F. Pennington, Titeflex, Inc.; G, Auxiliary Electrical Equipment, S. Ragonnet, Fairchild Camera Division; H, Spark Plugs, H. H. Vogel, Champion Spark Plug Co.; I, Turrets, L. J. Weber, General Electric Co.; J, Starters, Generators & Regulators, G. F. Cavanaugh, Jack & Heintz, Inc.; K, Instruments, H. N. Droge, Kollsman Instrument Co.; L, Navigational Instruments, R. G. Anderson, Sperry Gyroscope Co., Inc.; M, Auxiliary Power Units, R. R. Zoeller, Lawrance Aeronautical Corp.; N, Coolers & Radiators, J. C. Shaw, Young Radiator Co.; P, Turbo Supercharger, L. J. Weber, General Electric Co., and R, Photographic Equipment, C. M. Elliott, Eastman Kodak Co.

Council Changes Name of Activity

AIRCRAFT Powerplant Engineering Activity Committee is the new designation of the former Aircraft-Engine Engineering Activity Committee, as a result of Council action on April 6, in amending Section B-39 of the SAE Bylaws.

Members of the activity committee proposed the change in name in order to indicate that all types of aircraft powerplants, including turbines, are included in the scope of their technical interests.

The word *engine*, it was believed, generally connotes reciprocating units in the automotive industry. *Powerplant*, it was held, better defines the broad interest of the activity.

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Charts Aid Plotting Hardenability Tests

LATEST chart in a series of three prepared by Iron & Steel Division, SAE General Standards Committee, facilitates plotting steel hardenability test results for end-quench of L-bars.

The charts, in size 8½ x 11 in. have been made available at nominal cost to facilitate daily plant and laboratory use and to supplement revised methods for determining hardenability to be published in SAE 1945 Handbook. Chart No. 1 is for Jominy end-quench tests, and Chart No. 2 for cooling rates between center and surface of various materials.

All charts are coordinated with SAE Recommended Practice for conducting hardenability tests, especially daily routine testing of the hardenability of successive heats of steel by designating hardenability in terms of distance from the quenched end to which a certain hardness is obtained. This designation is regarded as adequate for comparing steels of different compositions with the hardenability of steel which has proved satisfactory in use. Additionally important application is estimating or predicting hardnesses obtainable with any steel in machine parts in advance of production.

Approximating hardenability by comparing the different sections of the part with

round or plate sections of similar size on which cooling rates have been determined will be presented in SAE Handbook as a satisfactory and more convenient method than either measuring by thermocouples, or by making the part, determining the hardness after quenching, and then comparing with Jominy tests.

T&M Engineering Setups Merged to Speed Projects

FRESH impetus and new vigor were given the SAE Transportation & Maintenance engineering program on March 16, when the T&M Technical Committee, a merger of the former SAE-ODT Coordinating Committee and the Sponsoring Committee, met to outline its assignments.

Integration of the two former committees, approved at the annual meeting of the SAE T&M Activity Committee, Jan. 8, in Detroit, was based upon a study which showed:

1. The ODT assignments had been tapering off in recent months. The new committee can function effectively on any requests asked of the SAE by the ODT or other Government agency, and

2. Simplification of the committee structure would benefit all phases of technical work, with subcommittees carrying out assignments made to it by the new Technical Committee.

Survey of existing projects is under way, and the new committee will add personnel as needed to the various subcommittees to speed the completion of their assignments.

Among the new projects agreed to by the T&M Technical Committee are:

"Rating of Power Take-Offs," an assignment turned over to Linn Edsall, Philadelphia Electric Co. He will name a western vice-chairman to assure complete coverage of geographic conditions in developing data on engineering ratings for this type of equipment.

"Vehicle Analysis Sheet," assigned to Austin M. Wolf, consulting engineer. A great need for such a form was expressed by Technical Committee members, some of whom indicated their belief that this project would lead to standardization.

Accepted by the Technical Committee was a progress report on "Tire Carriers," which will be filed for use, should this project be continued. S. G. Page, Equitable Auto Co., chairman of the subcommittee and a member of the new group, was given a vote of thanks for this project.

Members will study a request of the SAE Tire Cooperating Committee and report their findings to Merrill C. Horine, chairman, as soon as possible. This is an indication of the usefulness of the new group in coordinating work of other SAE projects.

Among the ideas posed for study by the T&M Technical Committee for further discussion were minimum cab dimensions, reclamation of connecting rods, and the accuracy of torsion wrenches at various periods of their lives.

Chairman of the new SAE T&M Technical Committee is Don K. Wilson, New York Power & Light Corp., Albany, and vice-chairman is E. N. Hatch, New York Transit System. Members include W. D. Bixby, United Parcel Service of N. Y., Inc.; W. J. Cumming, Office of Defense Transportation; Linn Edsall, Philadelphia Electric

Rambling Throug

NEW applications of petroleum products to industry were detailed by A. W. Hutchison, manager of the technical products department, Shell Oil Co. of Canada, Ltd., at **CANADIAN SECTION'S** Feb. 21 meeting . . . An extremely productive group of raw materials for the synthesis of an almost infinite number of products, including many organic chemical solvents, are olefin gases found in refinery gases produced by oil cracking processes, the speaker declared . . . He asserted that the surface of the petroleum industry has been no more than scratched, and hoped that in years to come chemists will unlock the secret of petroleum molecules, thereby producing an infinite variety of new and useful chemicals . . .

Over 158 members and guests accorded SAE President James M. Crawford and SAE General Manager John A. C. Warner a warm welcome at the same Section's dinner meeting March 21, which extended to a reception and luncheon given at the Granite Club by Section Chairman W. A. Wecker that day . . .

Work of air transport in the war and conversion problems involved in returning military transport and other aircraft to commercial operation was discussed at **DETROIT SECTION** April 2 meeting by Otto E. Kirchner, director of aircraft engineering, American Airlines, Inc. . . . Of local interest was talk by Glenn C. Richards, commissioner of the Department of Public Works, whose subject, the future of aviation in Detroit, covered the planning, building, financing and operating of airports in the metropolitan area . . . He disclosed that three new airlines have been approved for the city, and predicted that there will be four times the present volume of air traffic in Detroit within the next five years . . .

Telling about his personal experiences in motor transport work on the Burma Road, D. F. Myers, engineering consultant with Studebaker Corp., also covered the question of China as a post-war American market at Detroit Section's March 5 meeting. Shown during the address are (l. to r.): M. L. Bricker, Ford Motor Co.; SAE President J. M. Crawford; the speaker; SAE Detroit Section Chairman R. N. DuBois; and L. L. Colbert, who spoke to the gathering about the history of the Dodge Chicago plant, of which he is general manager

Star of **BUFFALO SECTION'S** March 14 Ladies' Night meeting, highlight of which was presentation of past-chairmen's certificates, was David Fergusson, chief engineer, James Cunningham, Son & Co., and first chairman of the Section who served from 1916 to 1918 . . . He related his part in the development of Pierce-Arrow as one of the foremost automobile manufacturers in the country – where he was employed as chief engineer for many years . . . Reminiscences of their careers were also recounted by Section Past-Presidents E. O. Spillman, Hirschell-Spillman Co.; William R. Gordon, and Earl W. Kimball, Gulf Oil Corp., making the session a historical review of automotive achievements . . .

Inspection tour of Wright Aeronautical plant at Lockland, Ohio, which lasted about five hours, comprised first part of **CINCINNATI SECTION'S** Feb. 15 meeting . . . Dinner which followed was enjoyed at the plant's dining room, after which R. T. Howe, assistant plant manager of the company, discussed the growth of Wright Aeronautical over a period of years, stating that in 1937 the company employed 3500 persons, while at present there are 80,000 on the payroll . . . 56,000 engines have been shipped from the Lockland plant to date, he informed the audience, and in addition to this the plant has built pistons and other parts for other companies licensed to use Wright radial engines . . .

Moving picture showing the plant in various stages of construction supplemented his address . . . Another movie on the B-29 bomber, showing routine inspection of the ship prior to take-off and return, concluded intensely interesting meeting . . .

Section Reports

Story of an aircraft engine originally designed for 750 hp with the thought that it could be developed into a 1000-hp engine and which now with special fuels has developed as high as 2700 hp with the same basic unit was colorfully told at **MILWAUKEE SECTION** March 2 meeting by R. M. Hazen, chief engineer, Allison Division, GMC . . . Special presentation of appreciation certificates to past-chairmen of the Section dating back to Section's birth in 1925 made a festive event of the meeting . . .

Chairman T. L. Swansen and R. M. Hazen, principal speaker, chatting after the meeting

SAE Milwaukee Section Chairman T. L. Swansen (left) is shown presenting the Section's second chairman, J. B. Armitage, engineering vice-president of Kearney & Trecker Corp., with his chairman's certificate, while Arthur Wollensak, chief engineer, Sterling Motor Truck Co., Inc., smiles his approval

Recently returned from a four-month tour of the China-Burma-India War Theater, Errol J. Gay, technical consultant on Fuels & Lubricants for the U. S. Army, presented a verbal and pictorial record of his observations before the **ST. LOUIS SECTION** March 20 . . . Ladies had been invited and attended in full force . . . Launching into a graphic presentation of the difficulties which beset our Army engineers in the construction of the Ledo Road, Mr. Gay told of the supply difficulties which had been solved to keep traffic moving through areas which had been considered impassable for wheeled vehicles since the dawn of civilization . . . Among startling facts brought out during his talk were: from 50 to 60% of supplies tonnage moved into China consists of petroleum products; and the immense labor involved in construction and operation of supply lines and facilities has created fantastic costs . . . Latter part of the program was devoted to the showing of photographic slides taken on his trip . . .

High point of interest and discussion of Karl H. Effmann's paper on determination of oil consumption at March 8 meeting of **INDIANA SECTION** was the specialized and developed method employed by Perfect Circle Co. in their engine testing procedure, with special reference to controlling the oil temperatures as well as the rpm, pressure of the test, and the apparatus employed to obtain maximum results . . . Slides illustrated why the use of a recording scale has been accepted as a dependable means of recording the consumption of oil during tests . . .

Two phases of the same screw thread idea – one known as the aero-thread system which is intended to be used for heavily loaded fastenings, and the other as the heli-coil system to impart strength when applied to soft materials – were analyzed by G. C. Brown, project engineer, Aircraft Screw Products Co., at April 4 meeting of **KANSAS CITY SECTION** . . . Application of these thread systems, Mr. Brown stated, is for maintenance repair as well as original manufacturing . . .

Sketching the remarkable growth and development of plastic materials and their extensive use as valuable wartime substitutes, Vernon S. Peterson, consultant

continued on next page

Co.; SAE Vice-President for Transportation and Maintenance Engineering E. P. Gohn, Atlantic Refining Co.; C. M. Hudson, Tennessee Valley Authority; G. W. Johnson, Bowman Dairy Co., Chicago; J. Willard Lord, Atlantic Refining Co.; M. E. Nuttila, Cities Service Oil Co.; S. G. Page, Equitable Auto Co.; Warren A. Taussig, Burlington Transportation Co.; E. W. Templin, Los Angeles Department of Water & Power, and A. M. Wolf, consulting engineer, New York.

Trailers Added to SAE Interchangeability Study

SAE work on development of standards for interchangeability of tractor semitrailer combinations has been extended to cover full trailers. This expansion followed a request arising from an informal meeting called by the American Standards Association on behalf of H. H. Allen, Bureau of Motor Carriers, Interstate Commerce Commission, for discussion of the Bureau's interest in facilitating interchange of tractors and trailers. Representing the SAE at the session were B. B. Bachman and W. P. Michell. Other organizations represented were American Standards Association, American Transit Association, Trailer Manufacturers Association, Automobile Manufacturers Association, and American Trucking Associations, Inc.

It was reported that the SAE last summer had organized a subdivision of the Motor Truck and Motorcoach Division of its Standards Committee to develop standards providing for interchangeability of tractor and semitrailer combinations. In organizing this subdivision, the general feeling developed that existing fifth wheel designs provided a high degree of interchangeability, and hence it was decided to emphasize the electrical and brake connections in the subdivision work.

The informal ASA conference agreed that – in view of this SAE activity – the technical phases of the problem were being cared for. Consequently, no immediate further action was proposed in this area. After the SAE has completed its technical work, the question then may be taken up as to what further steps should be taken through ASA or other channels.

Nutt Named by Hunt

AT the request of John H. Hunt, chairman of the SAE Standards Committee, the membership of its executive committee was increased by Council on April 6 from five to six. Mr. Hunt has appointed Arthur Nutt, director of aircraft engineering, Packard Motor Car Co., as the sixth member. Other members, beside Chairman Hunt and Mr. Nutt, are L. Ray Buckendale, F. P. Gilligan, W. E. Day, Jr., and E. W. Upham.

Appointments Made

COUNCIL on April 6 confirmed the appointments of G. W. Newton, Boeing Aircraft Co., and J. T. Rettaliata, Allis-Chalmers Mfg. Co., as members of the Aircraft Powerplant Engineering Activity Committee at the request of Vice-President Raymond W. Young.

Confirmation also was voted of the appointment of F. M. Buckingham, Wallace Barnes Co., Ltd., as a member of the Production Engineering Activity Committee at the request of Vice-President L. V. Cram.

Aluminum Casting Guide

MORE than 40 leading authorities have produced "Process Control of Aluminum Foundry Procedure," as members of the Aluminum Castings Committee of the SAE War Engineering Board. This 150-page, illustrated report is offered as a guide for insuring the control of aluminum foundry procedure.

Due to the demand for an unprecedented number of aluminum castings for the war effort, and the fact that many of the new practices had never been made available to newer manufacturers in this field, the War Engineering Board undertook this project at the request of the Central Aircraft Council more than a year ago.

The report is a compilation of recommendations of:

1. How to interpret castings;
2. How to control the methods of making castings, and
3. What pitfalls to avoid in foundry practice.

Aluminum foundries will find this material a great help in working out the details of problems which others have been forced to solve step by step and by the "cut and try" method.

Subjects dealt with in detail include: aluminum foundry core and molding sands; molding and pouring aluminum sand castings; melting and fluxing aluminum alloys; cleaning and heat treating; testing and quality control of sand castings; salvaging; foundry procedure and casting control records, and metal and refractory mold castings. Most of these topics were handled by special subcommittees of experts.

Copies are available to SAE Members for $1, and to non-members for $2.50, postpaid, from Special Publications Department, Society of Automotive Engineers, 29 West 39th St., New York 18, N. Y.

W.E.B. and W.M.C. Study Enemy Steels

REPRESENTATIVES of the Iron and Steel Committee of the War Engineering and the War Metallurgy Committee of the National Research Council are surveying the metallurgical possibilities of captured enemy motorized land equipment at Aberdeen Proving Ground.

The War Metallurgy Committee – to which the assignment was given some time ago of making metallurgical analyses of all enemy equipment – has asked the SAE War Engineering Board through its Iron and Steel Committee to go over the land automotive equipment from the viewpoint of the automotive engineer and metallurgist with the object in mind of submitting a list of metallurgical projects to the WMC in the order of their importance from an automotive standpoint.

Will Suggest Tests

The W.E.B. and its Iron and Steel Committee will also suggest the types of tests to which various parts should be submitted. Stress characteristics will determine to a large degree the metallurgical priority of the enemy parts and assemblies to be examined.

R. B. Schenck, chief metallurgist of the Buick Motor Division, General Motors Corp., has been selected to represent the W.E.B. Iron and Steel Committee in its association with the War Metallurgy Committee.

Rambling Throu Sec

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of the Extension Division, E. I. du Pont de Nemours & Co., told a gathering of 150 persons of the **CHICAGO SECTION** at its March 13 Parts & Accessories Meeting an absorbing story of progress made in plastic products that have been developed through chemical, engineering and other technical research . . . Despite the major advances that have occurred in plastics and design of products made from plastic materials, the speaker warned that talk of plastic automobiles, plastic houses and refrigerators was a little premature . . . They have yet to stand the test of competition with other products, he said, but pointed out that great strides have been made with plastic products in lines where concrete, wood, glass and steel had previously been considered the sole material . . . R. H. Brouch, vice-chairman of Chicago Section's Parts & Accessories Activity Committee, served as the meeting's technical chairman . . .

Second annual **CLEVELAND SECTION** student meeting March 23, sponsored by the Section for the advancement of SAE enrollment at Case School of Applied Science and Fenn College, was attended by more than 50 engineering students, half a dozen faculty men, and a like number of the Section governing board . . . A. T. Colwell did a typically excellent job with his paper on the future of the aircraft industry, followed by a Bell Aircraft movie on jet propulsion . . . Supplementary speaker was Roger Mahey, assistant manager, SAE Student Department, who helped boost SAE prestige among engineering students in the Cleveland area . . .

Roger Mahey, assistant manager, SAE Student Department, looks on as George Eccles, student chairman of Fenn College greets George Slater, student chairman of Case School of Applied Science at Cleveland's student meeting March 23

Photos Courtesy of Mawjr

Use of the Tocco process of induction heating for the treating of steel parts was explained at April 9 meeting of the Section by Harry B. Osborne, director of research, Tocco Division, Ohio Crankshaft Co. . . . He said that induction hardening makes possible the production of locally hardened steel objects with the desired magnitude and depth of hardness, essential metallurgical structure of core, demarcation zone and hardened case, with a practical dack of distortion and no scale formation . . . Another advantage he cited was that the process is readily adaptable to the heat treatment of war products . . .

Largest attendance of the season – of almost 400 engineers – was the boast of **SOUTHERN CALIFORNIA SECTION'S** March 8 meeting, where Willis M. Hawkins, Jr., chief preliminary design engineer, Lockheed Aircraft Corp., gave a detailed resume of the investigations that an aircraft company has to undertake before producing an acceptable small transport airplane . . . The first determinant is the mass of Civil Air regulations; the second is a study of the money-making potentialities of small aircraft . . . After analyzing many difficulties, Mr. Hawkins concluded that an airplane accommodating as few as 14 passengers could be designed and built and could operate economically enough to serve pioneer airlines . . . "Fighting Lady," movie produced by the U. S. Navy, was exciting climax to the meeting . . .

Changing ideas in physical metallurgy was the subject for the March 20 luncheon meeting of the San Diego Group of Southern California Section, which was discussed by Harry A Campbell, metallurgist and manager of research, Solar Aircraft Co. . . . Validity of test data for the selection of material and prediction of service life depends upon the following criteria, he said . . . Test conditions must simulate those of the intended service use; test results must be reproduced at will using the same conditions; test results must be correlated with service results; and tests must be made upon materials and structures truly representative of those used in actual service . . .

A tremendous increase in the quantity of aluminum will be available after the war, foretold P. B. Jackson, Aluminum Co. of America, who predicted at

Section Reports

PHILADELPHIA SECTION'S March 14 meeting a price structure competitive with iron and steel . . . He then reviewed the more important properties of aluminum which are factors governing its applications, saying that the increased strength available in certain alloys is the result of wartime research . . . Discussion following the paper evinced keen interest in light metal development among engineers and designers . . .

Addressing a meeting of the TEXAS SECTION Feb. 16, K. H. Knox, Globe Aircraft Corp. chief engineer, declared that the post-war private airplane which will be in greatest demand will be a smooth, four-passenger job . . . R. W. Cantwell, manager of Globe's Air Transport Division, spoke on feeder air transportation, stating that a general pattern to govern who shall operate the feeder lines probably will be decided at an early date by the Civil Aeronautics Board . . . Finale was showing of motion picture of a prototype of Globe's new Swift, a two-place post-war private plane, depicting the ship in flight tests . . .

Aeronautic meeting of NORTHERN CALIFORNIA SECTION March 12 drew a crowd of over 175 persons who heard a representative from Bell Aircraft Corp. point out that Bell has achieved a number of firsts in aircraft, including the first cannon-firing airplane, the Airacuda, and the first all-plastic fighter . . .

Principal speaker was W. V. Hanley, technical representative, Standard Oil Co. of Calif., who discussed the following topics in his talk on "Airplane Performance, from Private Plane to Transport Aircraft": (1) Review of air speed spectrum from balloons to meteors; (2) fundamental aerodynamic characteristics; (3) reduction of flight test data to standard conditions and preparation of long-range cruise charts for flight engineers; and (4) various operating characteristics of private aircraft from stall to maximum speed, including maximum climb angle, maximum rate of climb, maximum glide angle, normal cruising speed, and maximum economy air speed . . . Portion of Mr. Hanley's talk concerning the personal post-war plane was informative, as it dealt with a large number of private planes to be manufactured after the war, and gave their essential performance characteristics . . .

Thinking back to the 1850's, when automotive development actually started, Henry Cave, consulting engineer, Fuller Brush Co., recollected before the SOUTHERN NEW ENGLAND SECTION March 7 experiences of a pioneer automotive engineer . . . This involved a review of motor vehicle design in this country and Europe, and of the men who were responsible for such improvements as internal-combustion starts, compression starts, shaft drives, power steering, and power starting . . . Of the 50 persons who attended the meeting, more than half came to dinner . . .

Some of the troubles currently being experienced in the production of new civilian automotive vehicles and automotive repair parts necessary for the continued operation of existing automotive trucks and buses were outlined at March 13 meeting of WASHINGTON SECTION by Fred S. Glover, director, Automotive Division, War Production Board . . . Three years of war, he told an understanding audience, with no new passenger car production and with greatly reduced truck production have resulted in repair parts requirements which were unheard of in the pre-war era . . . However, his encouraging conclusion was that some of the trends in repair part demands may have valuable lessons for designers of post-war vehicles . . .

An age of research and reason in which husbands and wives will wear lead clothing and both can look through any window in town by pushing a button was envisioned by William B. Stout, director of research, Stout Research Division, Consolidated Vultee Aircraft Corp., at WICHITA SECTION meeting March 13 . . . A firm believer in the age of research, Mr. Stout predicted such an era will bring a downswing in crime and wars may eventually become obsolete . . .

Helicopters will never compete with the standard plane for high-speed travel, and they have very poor hovering ability above 5000 ft . . . So stated Prof. K. D. Wood, of the University of Colorado engineering department, before the joint meeting held by the SAE COLORADO GROUP and the ASME Feb. 15 . . . He also asserted that jet propulsion, particularly from a commercial standpoint, has been oversold to the public . . .

Aircooled Motors Corp. opened its doors to visitors from SYRACUSE SECTION March 19, when an inspection tour was made throughout the plant . . . Colored movies covering developmental work on the Bell helicopter presented in the engineering drafting room, with Art Young of Bell acting as narrator . . . Popularity of the film necessitated a triple showing to over 100 persons . . .

Student Branch News

ENGINEERING students of the *University of Colorado* held an organization meeting April 3 for the formation of a new SAE Club. Officers were elected and plans made for regular monthly meetings. Trygve Vik was elected chairman of the new Club, with Louis Kuh as Vice Chairman, Keith Powell as secretary and Norman Cairns as treasurer. Prof. William L. Hull is serving as faculty adviser.

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Members of the *SAE Branch of the College of the City of New York* exhibited a motion picture entitled "Diesel Engines," at the March 14 meeting of the Branch. The picture gave a detailed illustration of diesel principles, and included a study of the evolution of the two-stroke from the four-stroke diesel engine.

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SAE Enrolled Students attending *Case School of Applied Science* and *Fenn College* were guests of the SAE Cleveland Section at the Section's second annual student meeting on March 23. A. T. Colwell, Thompson Products, Inc., dinner speaker, presented a paper entitled "Looking Ahead in the Aircraft Industry." Examining the many ways in which air transportation is continuing development, Mr. Colwell indicated multiplied use of air cargo facilities as cost per ton mile drops, and predicted a post-war boom in air passenger service.

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At the March 20 meeting of the *Caltech SAE Branch* Mr. Graves of the Graves and Chubbuck Motorcycle Shop, Pasadena, led a discussion on developments and trends in motorcycles. He stated that the foot shift is here to stay because of the safer and easier operation that it affords. He declared that the future bearing trend will be toward solid bearings which, with the use of detergent oils, can be made to give better service than roller bearings at a reduction in cost.

W.E.B. Suggests Casting Practices

AT the request of the Office of the Chief of Ordnance – Detroit, special committees of the SAE War Engineering Board have submitted the recommendations of the casting industry covering methods that are acceptable for repair of gray iron, steel and malleable castings, together with a suggested foundry procedure to cover each type of casting.

OCO-D has already issued the recommendations of the gray iron committee in the form of an Engineering Bulletin. It is expected that Engineering Bulletins covering the repair of steel and malleable castings will soon be issued.

Three W.E.B. committees were organized. The members were drawn widely from some of the country's largest and most experienced foundries in the gray iron, steel and malleable fields. W.E.B. Sponsor for all three committees was R. H. McCarroll, executive engineer, Ford Motor Co. Chairman of the gray iron committee was L. A. Danse, General Motors Corp.; of the malleable committee, Charles W. Morrison, Saginaw Malleable Iron Division, General Motors Corp.; and of the steel committee G. Vennerholm, Ford Motor Co.

SAE Coming Events

Baltimore – May 10

Engineers Club; dinner 7:00 p.m. What Has Retarded the Growth of Private Flying – William T. Piper, senior president, Piper Aircraft Corp. More Landing Facilities – The Key to Private Aviation's Growth – Lee H. Smith, manager, Personnel Aircraft Sales, Fairchild Aircraft Division. Post-War Aviation Developments and Prospects – Richard King, assistant to president, Taylor Craft and Aviation Corp.

Buffalo – May 1

Statler Hotel; High Conductivity Cooling Fins for Aircraft Engines – James C. Cunningham, Wright Aeronautical Corp. Single Cylinder High Altitude Cooling Tests – M. Piry, Ranger Aircraft Engines Division, Fairchild Engine and Airplane Corp. Aircraft Spotwelding at Willow Run – H. A. Mullen and L. Boelter, Ford Motor Co. Aircraft Riveting and Equipment – Frank Dietrich, Curtiss-Wright Corp. Dinner Speaker: An Attack with Task Force 58 – William J. Crosswell, Airplane Div., Curtiss-Wright Corp. Structural Model Testing – O. W. Loudenslager, Goodyear Aircraft Corp. Helicopters – W. Laurence LePage, Platt-LePage Aircraft Co.

Chicago – May 8 and 21

May 8 – Knickerbocker Hotel; dinner 6:45 p.m. The Battle for Leyte Gulf – J. M. Carson, captain, U.S.N., U. S. Naval Air Station, Glenview, Ill. Illustrated by Government combat films. Ladies invited.

May 21 – LaSalle Hotel, South Bend; dinner 6:45 p.m. Heat Transfer Equipment of Automotive Vehicles – A. B. Arnold, assistant chief engineer, Modine Manufacturing Co.

Cincinnati – May 22

Alms Hotel; dinner 6:30 p.m. The Place of Truck and Semi-Trailers in the Transportation Fleet – J. F. Winchester, general manager of automotive equipment, Standard Oil Co. of N. J. Colored movies.

Cleveland – May 17

Carter Hotel; Various Types of Compressors for Supercharging – R. J. S. Pigott, Gulf Research and Development Co. Engine Bearing Development – Up-To-Date – H. W. Leutkemeyer, Cleveland Graphite Bronze Co. Navy Experience with Diesel Fuels and Lubricants – Lt. Com. H. F. Galindo, USNR, head, Petroleum and Rubber Section, Bureau of Ships. Slow Motion Study of Injection and Combustion of Fuel in a Diesel Engine – C. D. Miller, Fuels and Lubricants Division, National Advisory Committee for Aeronautics. Dinner Speaker: The Future Responsibilities of the Engineer – C. F. Kettering, General Motors Research Labs. Division.

Detroit – May 7 and June 4

May 7 – Horace H. Rackham Educational Memorial Bldg.; Aircraft Engine Gears – F. R. McFarland, Packard Motor Car Co. Silver Bearings – E. B. Etchells and Arthur Underwood, General Motors Research Labs. Symposium – Evaluation of Axial vs. Centrifugal Superchargers. Axial vs. Centrifugal Superchargers for Aircraft Engines – W. J. King, General Electric Co. Some Advantages and Limitations of Centrifugal and Axial Aircraft Compressors – Kenneth Campbell and John E. Talbert, Wright Aeronautical Corp. Symposium – The Light Airplane: Service Experiences with Light Aircraft Engines – R. D. Hicks, Continental Motors Corp. The Post-War Market for Personal Planes – R. A. Robinson, Crowell-Collier Publishing Co. Operating Cost of Light Aircrcaft – John Friedlander, Aeronca Aircraft Corp. A Resume of Desirable Characteristics for Non-Stalling Non-Spinning Airplanes – R. B. Maloy, Civil Aeronautics Administration. Dinner Speaker: Helicopter Construction Problem – Thomas Harriman, Helicopter Development Engineer, Bell Aircraft Corp. Problems and Objectives of the SAE – J. M. Crawford, chief engineer, Chevrolet Division, General Motors Corp. and president, SAE.

June 4 – Book-Cadillac Hotel; dinner 6:30 p.m. Silicones – Their Engineering Aspects and Fields of Application – W. T. Eveleth, General Electric Co. What Can Be Done with the Electron Microscope – Speaker to be announced. Report of Ordnance Officers from Combat Areas – Lt. Col. E. H. Holtzkemper, head, Transport Vehicle Branch, OCO-Detroit. Maj. J. J. Robson, Rubber Section, OCO-Detroit. Maj. A. E. Cleveland, OCO-Detroit. Coffee Speaker: Mayor Edward Jeffries. Wartime Developments in Automotive Engineering – C. L. McCuen, vice president, General Motors Corp. Motion Pictures. Education Project Report – W. T. Fishleigh. Body Standards Report – E. C. DeSmet.

Indiana – May 10

Antlers Hotel; dinner 6:45 p.m. Design Details of Aluminum and Magnesium; Sand and Die Castings; Permanent Mould and Forgings – R. G. Anderson, Engineering Department, Aluminum Co. of America.

The 1945 Semi-Annual Business Meeting of the Society will be held at the Detroit Section War Emergency Meeting, June 4, just prior to the presentation of the speakers at the dinner in the evening.

Kansas City – May 14 and June 7

May 14 – Continental Hotel; dinner 6:30 p.m. Diesel Engine Goes to War and to Post-War – L. J. Maloney, advertising manager, Detroit Diesel, General Motors Corp.

June 7 – Continental Hotel; dinner 6:30 p.m. The Design of Electro-Mechanical Actuating Systems – H. W. Adams and Fred Foulon, Douglas Aircraft Co., Inc. Future Aircraft Electrical Loads – Austin F. Trumbull, United Airlines Representative, Douglas Aircraft Co. Auxiliary Power Systems for Aircraft – M. M. Berry, Dennis DeCourcey, Karl Martinez and Sidney Schnitzer, Boeing Aircraft Co. Category Licensing Tests – R. C. Loomis, Transcontinental and Western Air, Inc. Package Heating Systems – H. R. Porter, Transcontinental and Western Air, Inc. Symposium – Indoctrination of Airline Personnel to New Equipment. Chairman – Commander A. F. Bonnalie. Speakers – Capt. C. H. Schildhauer, USNR. Lt.-Col. N. K. Warner, chief, Training Division, Operations, Army Air Corps, will present paper prepared by H. B. Fisher, Technical Adviser, Mechanic and Engineer Training, Operations, Air Transport Command. Daniel B. Woodyatt and Arthur W. Jerrems, United Air Lines. W. B. Lester, American Airlines, Inc. R. C. Stunkel, Lockheed Aircraft Corp.

Metropolitan – May 10 and 24

May 10 – Pennsylvania Hotel, New York; meeting 8:00 p.m. Symposium – Post-War Brakes: R. K. Super, Timken Detroit Axle Co. J. George Oetzel, Wagner Electric Brake Co. Joint paper by Messrs. R. J. Keller and H. F. Schippel of B. F. Goodrich Co.

May 24 – Pennsylvania Hotel, New York; meeting 8:00 p.m. Jet Propulsion – Ben Hamlin, Bell Aircraft Corp. Motion Pictures.

Mid-Continent – May 4

Biltmore Hotel, Oklahoma City; meeting 7:30 p.m. Porous Chrome for Engine Cylinders – Russell Pyles, chief engineer, Van Der Horst Corp. of America.

Mohawk-Hudson Group – May 14

Engeral Engineering Bldg., Schenectady; dinner 6:30 p.m. Bouncing Putty and Other Silicone Products – Donald F. Wilcock, chemical engineer, General Electric Research Lab. Demonstrations and Exhibits.

New England – May 1

Engineers Club, Boston; dinner 6:30 p.m. Warring With Petroleum – Charles W. Ehlmer, Jr., assistant supervisor, Engineering Division, Sales Department, Standard Oil Co. of N. J.

Northwest – May 4

Mt. Rainier Motor Repair Base, Fort Lewis; dinner 7:30 p.m. Trip Through Motor Repair Base and Inspection of Salvage Methods and Facilities. Meeting limited to SAE members and invited guests.

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Oregon – May 4

Imperial Hotel; dinner 7:00 p.m. Speaker and subject to be announced.

Peoria – May 11

Jefferson Hotel; dinner 6:30 p.m. Turbosuperchargers. Speaker to be announced.

Philadelphia – May 9

Engineers Club; dinner 6:45 p.m. Warfare Sciences and Post-War Uses – Dr. Gerald Wendt, science editor of *Time* and *Life*. Presentation of certificates of appreciation to Past-Chairmen. Ladies invited.

Pittsburgh – May 9

University Club; dinner 6:30 p.m. Maintenance Engineering of Chassis Leaf Springs – Robert N. Austen, Iron City Spring Co. Motion Picture at Luncheon – A Day with the A-36's. Field Performance of Synthetic Tires – R. E. Blake, United States Rubber Co. The Use and Evaluation of Heavy Duty Engine Oils – Dr. O. L. Brandes and H. H. Donaldson, Jr., Gulf Research & Development Co. Our Sights are High – James M. Crawford, chief engineer, Chevrolet Division, General Motors Corp. and president, SAE. Greetings to Pittsburgh – John A. C. Warner, secretary and general manager, SAE. Transportation and Maintenance Problems in the China-Burma Theater of War – Errol J. Gay, manager Commercial Division, Ethyl Corp.

St. Louis – May 15

Chase Hotel; Putting Exhaust Gas to Work – R. W. McLaughlin and C. F. Harms, Elliott Co. Diesel Engine Paper – Nicholas Fodor, Diesel Engineering & Mfg. Corp. Symposium on Economics of Diesel Engine Operation: Engine Manufacturer – F. G. Shoemaker, Detroit Diesel Division, General Motors Corp.; Fuel Manufacturer – W. M. Holaday and W. S. Mount, Socony-Vacuum Oil Co., Inc. User – Bryan Park, Central Greyhound Lines. Dinner speaker: The Mechanics of the Earthworm Tractor Stories – William Hazlett Upson.

Salt Lake Group – May 14

New House Hotel; meeting 7:30 p.m. Oil Filtration and its Problems – E. N. Bentley, DeLuxe Products Co.

Southern California – May 3

Hollywood Roosevelt Hotel, Hollywood; dinner 7:00 p.m. Production Problems on the P-61 Black Widow Night Fighter – R. R. Nolan, Northrop Aircraft, Inc. Powdered Metal Parts – A. J. Langhammer, president, Amplex Division, Chrysler Corp.

Spokane Group – May 11

Spokane Hotel; dinner 7:00 p.m. General Maintenance Program – Walter T. Thorsen, Overland Greyhound Stages.

Washington – May 8

Statler Hotel; dinner 7:00 p.m. Human Engineering In Army Air Forces – Col. W. R. Lovelace 11, Med. Lab., Wright Field.

Western Michigan – May 17

Occidental Hotel, Muskegon; meeting 7:45 p.m. Spring Designing and Testing. Engine Dust Testing. Boat Engines. Speakers to be announced.

Council Approves Hawaiian Section

COUNCIL authorized on April 6 the Hawaiian Section, newest of the 29 Sections of the Society. Approximately 65 SAE members and applicants live on Oahu and neighboring islands of the archipelago, active in vehicle and aircraft operations activities.

The petition was presented formally to Council by Levert A. McDonell, secretary, who extended his trip to the United States to discuss the authorization of the new Section in person. He emphasized the importance of a formal organization of SAE members in Hawaii because that Territory is expected to be an important crossroad in the Pacific hemisphere at war's cessation.

Active in organizing the new Hawaiian Section, photographed at a meeting on Jan. 22, were (seated, left to right): J. W. Rogers, chief engineer, Continental Trailer & Equipment Co., treasurer; S. N. Castle, consulting engineer, chairman of the Organization Committee; Ira K. Black, superintendent of automotive equipment, Rapid Transit Co., Ltd., chairman. (Standing, left to right): Malcolm H. Love, Shell Oil Co., Inc.; Levert A. McDonell, secretary; W. B. Meredith, chief engineer, C. M. Lovstedt & Co. (Hawaii) Ltd., vice-chairman, and B. J. Eaves, manager, Coca Cola Bottling Co. W. J. Maze, engineer, C. Brewer & Co., Ltd., not shown, is also a vice-chairman of the new Section

W.E.B. Helps Ordnance In Carbon Black Crisis

WHEN the sudden shortage of carbon black recently threatened to restrict the production of rubber parts for military vehicles through sweeping directives of the WPB, the office of the Chief of Ordnance – Detroit appealed to the War Engineering Board for help. W. J. McCortney, chairman, W.E.B. Rubber Committee, sent an SOS to the committee members.

Two emergency meetings were held. Every rubber part which would suffer reduction or elimination of carbon black through the contemplated directive was reviewed and the committee's recommendations recorded. In a number of cases the proposed reductions of carbon black would not interfere with the functioning of the part. But where a reduction would impair the operation of military vehicles, the terms of the order were questioned.

The final recommendations of the committee were rushed to the W.E.B. for approval and members of the committee with representatives of OCO-D flew to Washington for special meetings with members of the WPB Rubber Director's Staff.

Virtually every request of the W.E.B. Rubber Committee was granted. But by preserving the essential wearing qualities which carbon black introduces into rubber for our military vehicles, civilian tires and civilian replacement rubber parts will doubtless suffer doubly until the supply of carbon black can be built up to meet the requirements of the rubber industry. Already the allotment of tires for civilian use has been cut down for the next two months.

Accepts French Greetings

IN response to a resolution of greetings to the SAE from the Societé des Ingenieurs de L'Automobile, France, President James M. Crawford wrote, in part, that "Automotive progress, bringing the peoples of the world closer together, should strengthen the bond between the SIA and SAE.

"That stronger bond," he continued, "should form the basis for a continuing effort mutually to direct automotive engineering to the creation and the service of a world made better by lasting peace."

Prior to the war numerous members of the SIA were also SAE members, and frequently delegations of the French society attended SAE meetings in this country.

Vincent Bendix

(1882-1945)

VINCENT BENDIX, president of the SAE in 1931 and a life member of the Society, died of coronary thrombosis on March 27, 1945, in New York City at the age of 62.

Engineer, inventor and industrialist, Mr. Bendix was widely known for his many inventions, one of which, the Bendix drive, made the application of self-starters for motor vehicles widely popular. Mr. Bendix also introduced into the United States the first volume production of four-wheel brakes.

The companies founded by Mr. Bendix to manufacture brakes and starter drives formed the basis of the group which later he consolidated as Bendix Aviation Corp., the organization which, under his leadership, grew to be one of the great automotive manufacturing units of the country.

As founder and sponsor of the Bendix Transcontinental Air Race and donor of the Bendix Trophy, he early evinced his deep interest in aviation development. After formation of Bendix Aviation Corp., his interest in the growing industry was intensified.

Stating that he would devote his time to the field of aircraft development upon resigning from Bendix Aviation Corp. three years ago, Mr. Bendix formed Bendix Helicopter, Inc., in June, 1944, successor to Helicopter, Inc., a corporation he organized in 1943. He had already developed a four-passenger helicopter sedan designed for mass production after the war.

Immediately upon joining the SAE in 1916, Mr. Bendix manifested a keen interest in and a desire to promote the work of the organization.

Of Swedish ancestry, Mr. Bendix was born Aug. 12, 1882 in Moline, Ill., the son of the Rev. John Bendix, a Methodist minister, and Alma Danielson Bendix. At the age of 16 he went to New York City, convinced that his forte lay in mechanical devices rather than the pursuit of law, which he had contemplated. This inclination led him to design improvements of bicycle chains and sprockets which brought him in touch with bicycle manufacturers and paved his way into the automobile industry. In 1908 he engaged in business for himself, manufacturing the Bendix car, and perfecting his starter-drive which has been used on an estimated 65,000,000 motor vehicles and airplanes.

In 1929 Mr. Bendix gave $65,000 to the City of Stockholm for the purchase of a complete Lama Temple, and was decorated by Sweden when he visited King Gustav in December of that year. The French Government also bestowed upon him the Legion of Honor. That same year he gave assistance to the extent of $130,000 for an archeological expedition to Tibet and other Asiatic countries, undertaken by Dr. Sven Hedin.

About SAE Members

JOINS FORD

W. S. James

WILLIAM S. JAMES, past-president of the SAE, has been appointed director of automotive research for the Ford Motor Co., **HENRY FORD II,** executive vice-president of the company, announced. The new division will function as a part of the Ford automotive engineering department under **R. H. McCARROLL,** the company's executive engineer.

Mr. James joined Studebaker Corp. in 1926, and 10 years later became chief engineer. Upon graduation with honors from George Washington University in 1917, he joined the National Bureau of Standards, serving as its Power Plant Section chief from 1921 to 1924.

As past-president of the Society, Mr. James continues as a member of Council until the end of 1946. He is chairman of the SAE Publication Committee, is SAE member of the board of the Coordinating Research Council, Inc., and is active on a number of the Society's technical committees. He is a member of the NACA Power Plants Committee, a Fellow of the American Physical Society, a member of the ASTM, and ASME. Last year he won the George Washington University Alumni Award for scientific achievement.

IVAN F. WEEKS has recently been appointed research engineer, California Institute of Technology, Pasadena, Calif. He was formerly research engineer, Shell Oil Co., Inc., Wood River, Ill.

CARL J. LESKA, who had been an engineer with Thompson Products, Inc., now holds the position of assistant to general superintendent, Aircraft Accessories Division, same company, Cleveland.

LT.-GEN. WILLIAM S. KNUDSEN resumed his duties as the War Department's director of production as of May 1, having finished a special assignment as director of the Air Technical Service Command, AAF. He will be succeeded by Major-Gen. Bennett E. Meyers, formerly deputy director of ATSC and commanding general of Wright Field, Dayton. Gen. Knudsen was transferred from the Army Service Forces last July by General of the Army Henry H. Arnold, AAF commanding general, to combine the functions of the former Air Service and Air Materiel commands.

FAYETTE (CY) LEISTER has been advanced to the position of engineering manager, Fafnir Bearing Co., New Britain,

Fayette (Cy) Leister

Conn., where he will head all phases of product design and development. For the past 10 years he had been manager of the Detroit territory for the company.

RAYMOND L. FITCH is now the owner of Fitch and Hartley, Santa Monica, Calif., and is acting in the capacity of consulting metallurgical engineer.

After three years of living under Nazi domination, **RENE M. PETARD,** French engineer and life member of the Society since 1919, is, in his own words to the SAE, "still alive and going strong," despite solid occupation of his home by the Boche – who pushed him and his wife into their smallest and dingiest room as a last and only shelter.

Enthusiastic over the performance of American-made military vehicles which he drove and inspected, Mr. Petard congratulated the SAE for its part in this production, complimenting today's engineers as "worthy successors" to automotive old-timers.

With a Frenchman's appreciation of beauty plus quality, his one suggestion toward complete perfection of the post-war car was to simplify and improve its shape.

Appointment of **CHARLES CUMA** as chief design engineer on engines for Willys-Overland Motors, Inc., Toledo, Ohio, was

Charles Cuma

announced by **D. G. ROOS,** vice-president in charge of engineering. Mr. Cuma had been development engineer of Atlas Imperial Diesel Engine Co., Chicago.

ALEX TAUB, who is no longer chief engineer of the Foreign Economics Administration, has organized Alex Taub Associates, Washington, D. C., where he is concerned with international industrialization problems. Mr. Taub is a former SAE councilor.

Formerly product engineer of the Aircraft Division of Packard Motor Car Co., Detroit, **RICHARD H. DICKENSHIED** is now assembly engineer of the Toledo Division of the same company.

JOHN WALKER, formerly assistant to the chief engineer of Mack International Motor Truck Corp., has been appointed manager of the sales engineering department in New York City. Mr. Walker has been on Mack's engineering staff since 1918.

John Walker

WILLIAM C. LAWRENCE, chief engineer, American Export Airlines, Inc., New York, has been appointed vice-chairman of the SAE Aircraft Accessories & Equipment Subdivision by **WILLIAM LITTLEWOOD,** chairman. Since the formation of the Subdivision, Mr. Lawrence has been one of its most active members and has participated in major policy decisions.

PAUL H. WILKINSON, consulting engineer with offices in New York City, has just compiled the third edition of his international reference book "Aircraft Engines of the World" in revised and enlarged form. So fast moving is the aircraft engine field today that about 60% of the standardized data pages and 45% of the photographs have had to be changed since the 1944 edition was issued last year. Jet propulsion

Paul H. Wilkinson

engines now have a special section of considerable interest, and many new Allied as well as Axis engines are described. Revised tabulations contain particulars of nearly 200 of the latest engines of the United States, Great Britain, Australia, France, Germany, Italy, Japan and the U. S. S. R. This book is published by the author, 216 E. 45 St., New York City.

GEORGE H. COMPTER, who for the past several months had been staff engineer in the Aeronautics Department, SAE Headquarters Staff, has been appointed chief production engineer of Link Aviation Devices, Inc., Binghamton, N. Y. Before coming to the SAE, Mr. Compter had been employed by Brewster Aeronautical Corp. as manager of the inspection salvage department.

JOHN W. WELTY is now staff assistant in the production engineering department of Ryan Aeronautical Co., Lindbergh Field, San Diego, Calif. He was formerly chief metallurgist of Bell Aircraft Corp., Buffalo, N. Y.

Previously senior engineer, Aeronca Aircraft Corp., Middletown, Ohio, **ROBERT L. SUTHERLAND** is now special research assistant in the department of theoretical and applied mechanics, College of Engineering, University of Illinois, Urbana, Ill.

A former student at the University of Detroit, **PAUL EUGENE GIES** is now a chief mate in the U. S. Naval Reserve and is stationed at San Mateo, Calif.

Formerly a student member of the SAE, **JOHN E. BRADBURN** is now a member of the Naval V-12 Unit and is studying at Pioneer Hall, University of Minnesota, Minneapolis.

Engineering Heads Named for Packard Post-War Growth

Packard Motor Car Co. engineering executive appointments, recently announced by President George T. Christopher, will consolidate the company's multiple post-war engineering work under Vice-President Col. J. G. Vincent (left). At his right are: W. H. Graves, the new executive engineer; Arthur Nutt, who will direct aircraft engineering; C. R. Paton, chief engineer since 1932, who continues to direct automotive engineering; and Marsden Ware, who will head up marine and industrial engineering. F. R. McFarland, not shown, will direct the new Engineering Research Division, supplementing the work of the other divisions

VICTOR C. MOORE is now a private first class in the U. S. Marine Corps, and may be reached at Signal Battalion, Company A, Camp Lejeune, N. C. Before his induction he was field service engineer for AC Spark Plug Division, General Motors Corp., Flint, Mich.

RECEIVES ARMY'S HIGHEST AWARD

THEODORE PAUL WRIGHT, below left, administrator of the Civil Aeronautics Administration, received the Army's highest civilian award from Major-Gen. Oliver P. Echols, AAF, assistant chief of air staff, a commendation for exceptional civilian service on behalf of Secretary Henry L. Stimson, War Department. He was cited for his role in the Nation's aircraft production program while director of the Aircraft Resources Control Office, and a member of the Aircraft Production Board. Mr. Wright enlisted in the Government's aircraft program five years ago. He accepted the citation, at a ceremony attended by high-ranking American and British officials, "on behalf of all the people who had worked on the program in ARCO, officers of the Navy Bureau of Aeronautics, Army Air Forces, and the plants which have produced the vast armada." Production rose from 6,086 planes in 1940 to 96,369 in 1944. He left ARCO on Sept. 23, 1944, to head the administration of CAA upon presidential appointment.

JOHN P. GOBETTI, who was formerly design engineer, Glenn L. Martin Co., Baltimore, Md., is now manager of the mechanical design department of the Goodyear Aircraft Corp., Akron, Ohio.

FRANK P. HERMAN has been advanced to the executive vice-presidency of Purolator Products, Inc., Newark, N. J., after an association with the company of over 18 years in executive capacities. Before his promotion Mr. Herman was vice-president in charge of equipment sales. **MARTIN J. STOLZ,** previously assistant manager of equipment sales, is now manager in the same department.

Frank P. Herman

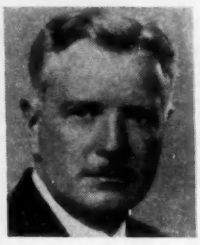
DR. TRACY C. JARRETT, chief metallurgist of the American Hammered Piston Ring Division of the Koppers Co., Inc., Baltimore, Md., has been appointed to the technical committee of the Gray Iron Founders' Society. Dr. Jarrett, formerly assistant chief metallurgist of the American Optical Co., is the author of a number of technical articles and inventor of the Jarrett metallurgical polishing and lapping machine.

VINCENT G. DODDS has left his position of president of Ben-Hur Products, Inc., Los Angeles, Calif., and has taken a similar position with the Machinists' Tool & Supply Co., same city.

Formerly research engineer, Chrysler Corp., **GEORGE D. McCARTHY** is now project engineer, Rubber-Plastics Laboratory,

Engineering Division, same company, Highland Park, Mich.

Henry F. Pope **W. H. Moriarty**



Henry F. Pope, who had been chairman of the board of National Malleable & Steel Castings Co. since 1934, resigned from this post at the 78th annual meeting of the organization

W. H. Moriarty, assistant to the president of National Malleable & Steel Castings Co., now has additional duties of aiding in the administration of the railway sales department

RONALD B. SMITH, who had been manager of engineering research and development, Elliott Co., Jeannette, Pa., has been elected vice-president in charge of engineering for the organization, a newly created post.

J. EDWARD TRAINER has been appointed assistant to **JOHN L. COLLYER,** special director of rubber programs of the War Production Board. Mr. Trainer, who has a broad background of experience in production, engineering and construction, is on loan for a limited period from Firestone Tire & Rubber Co., of which he has been vice-president in charge of production for the past seven years.

Formerly a civilian employee of the U. S. Naval Engineering Experimental Station, Annapolis, Md., **V. L. MALEEV** is now consulting mechanical engineer with Harvey Machine Co., Inc., Los Angeles, Calif.

JOHN S. KOHAT, formerly stationed at the Coast Guard Vessel Repair Shop, Miami, Fla., may now be contacted at San Pedro, Calif.

Formerly assembly foreman, Mack Mfg. Corp., Allentown, Pa., **MIGUEL ORDORICA** is now head of quality engineering of Willys-Overland Motors, Inc., Toledo, Ohio.

C. D. BREWER recently has been appointed chief research engineer of Shell Lubricating Oil Laboratory, Thornton, of Shell Refining & Marketing Co., Ltd., Chester, England. He was formerly engineer in charge of the same branch of the company.

Previously project engineer of Continental Motors Corp., Detroit, **SIDNEY POTTINGER** is now a consulting engineer working on internal-combustion engines, and may be reached at Peru, Ill.

J. B. ROBINSON, who had been automotive engineer of Kendall Refining Co., Bradford, Pa., is now affiliated with the H. A. King Co. of Detroit.

CHARLES J. MURPHY, a sergeant in the U. S. Army, has been transferred from Fort Belvoir, Va., to A. P. O. 18397, c/o Postmaster, San Francisco.

LEE A. BENSON, JR. has recently joined Wright Aeronautical Corp., Paterson, N. J., as test engineer. Mr. Benson had been laboratory engineer, Aircooled Motors Corp., Syracuse, N. Y.

KENNETH HENRY JACOBS, who had been an engineer with the Holley Carburetor Co., Detroit, is now serving in the U. S. Navy as a radio technician, third class, and may be reached at the Naval Training School, Navy Pier, Chicago.

SAE members who have received recent changes in company status include: **FRANK OBERLE,** American Bosch Corp., formerly manager of the Cleveland branch, is now manager of the Chicago branch; **SAMUEL C. ATKINS,** previously manager, aeronautic service, Sperry Gyroscope Co., Inc., Brooklyn, N. Y., to assistant manager of the New Orleans district office; **B. R. ESCHWEILER,** Minneapolis Moline Power Implement Co., formerly experimental engineer, is now junior research engineer; previously tractor and powerplant salesman, McCarty-Sherman Distributing Corp., Denver, Colo., **MARSHALL S. ANDERSON** is now service manager.

RAYMOND P. LANSING, vice-president and group executive of Bendix Aviation Corp., Teterboro, N. J., has been elected a director of the organization. As group exec-

Raymond P. Lansing

utive, Mr. Lansing is in charge of the Eclipse-Pioneer, Philadelphia, and Scintilla Divisions of the corporation. He is a former member of the SAE Aircraft Engine Activity Committee.

P. W. LITCHFIELD was re-elected chairman of the board of the Goodyear Tire & Rubber Co. at the annual meeting of its directors on March 26. Discussing problems still confronting the rubber industry, Mr. Litchfield said "1944 may be classified as a year of 'plugging' for production of needed war goods."

JACK FRYE, president of Transcontinental & Western Air, Inc.; **RALPH DAMON,** vice-president and general manager, American Airlines, Inc.; and **C. BEDELL MONRO,** president of Pennsylvania Central Airlines, have been named to a special committee to assist the Aircraft Division of the War Production Board in formulating a requirements program for new aircraft for American commercial airline operators.

Formerly assistant to the vice-president of Bareco Oil Co., Tulsa, Okla., **JOHN V. BRAZIER** is now affiliated with Petroleum Marketing Co., same city.

Formerly assistant production engineer, assembly and repair shop, Naval Air Station, Jacksonville, Fla., **B. FURMAN WILKES,** lieutenant (jg) in the U. S. Naval Reserve, is now assembly and repair shop engineering officer in the Naval Air Station, Norman, Okla.

G. HAROLD OSBORNE, who had been field service supervisor of the Kendall Refining Co., Bradford, Pa., has been promoted to manager of the lubricating oil sales department, same company.

HUBERT R. O'NEIL, JR. is now connected with Butler-Huff & Co., investment bankers of Los Angeles, Calif., and is an industrial specialist in financing, reorganizations and mergers.

FORREST A. STINSON, who had been a captain in the Motor Transport Unit, U. S. Army Signal Corps, Camp Crowder, Mo., has returned to his former civilian position as sales engineer with Delco-Remy Division of General Motors Corp., Anderson, Ind.

MILLER McCLINTOCK is now associated with the Encyclopaedia Britannica staff. He was formerly president of the Mutual Broadcasting System, Inc., New York City.

Formerly at the Dearborn, Mich., branch of Harry Ferguson, Inc., **MERRITT D. HILL** may now be reached at the Oakland, Calif., branch of the same company.

EDWARD A. SUTHERLAND, a captain in the U. S. Army Air Forces has been transferred from A. P. O. 558, c/o Postmaster, New York, to Chanute Field, Rantoul, Ill.

Formerly production superintendent, Superior Tool & Engineering Co., Muncie, Ind., **ROBERT E. EVANS** is now a partner in the South Park Engine Co., Dayton, Ohio.

R. W. BOLZ, who had been assistant engineer, National Carbon Co., Inc., Cleveland, is now assistant editor of *Machine Design Magazine,* Penton Publishing Co., Cleveland.

Alfred R. Code (right), who is connected with the Ministry of Supply, London, England, was a recent visitor to SAE Headquarters in New York City. Mr. Code, who has been a member of the Society since 1934, has written prolifically about engine design and fuels and lubricants developments, contributing to many technical journals and newspapers

J. F. McWhorter (right), research chemist of Ohio Rubber Co., Willoughby, Ohio, has been appointed by the Office of Rubber Bureau of the War Production Board a member of the Mechanical Rubber Goods Consulting Committee of that office. The purpose of this committee is to consider problems concerning the technology of mechanical rubber goods

Formerly at Northwestern Technical Institute, **JOHN W. GRAHAM** is now serving in the U. S. Navy as an ensign, and may be contacted at Box 5423, State College Station, Raleigh, N. C.

Formerly production liaison engineer, Wright Aeronautical Corp., Paterson, N. J., **JAMES OTIS KING** is now senior engineer, Product Engineering Division, Turbosupercharger Group, Plant No. 7 of the same company, Woodbridge, N. J.

HARRY S. PACK, JR., director of functional engineering for Pennsylvania-Central Airlines, has been elected chairman of the newly formed Passenger and Cargo Handling Equipment Committee of the Air Transport Association. The responsibility of this committee will be to coordinate and develop passenger and cargo handling equipment standards to ensure the airlines the most efficient and economical means of handling passengers and cargo.

HENRY E. BEYSTER, president of the H. E. Beyster Corp., Detroit, spoke at a meeting of the Chamber of Commerce of Port Huron, Mich., on March 21, on "Port Huron and its Opportunities."

WILLIAM R. MUNFORD has recently been appointed research engineer, Kendall Refining Co. of Bradford, Pa. He was previously chassis layout draftsman for Chrysler Corp., Detroit.

JAMES M. ROBINSON, who had formerly been assistant to the department manager, Airplane Division, Curtiss-Wright Corp., Bloomfield, N. J., is now serving in the U. S. Naval Reserve as an ensign, and may be reached at Fleet Post Office, San Francisco, Calif.

E. J. HESS, who is connected with Continental Motors Corp., Detroit, has been named assistant chief plant engineer of the company. He was formerly superintendent of test equipment.

E. J. Hess

Formerly a student at Detroit Institute of Technology, **ROBERT G. RAWLINSON** is now an analytical engineer in the structures group, Naval Air Experimental Station, Naval Air Material Center, Philadelphia Navy Yard, Philadelphia, Pa.

GEORGE V. FRUSHOUR, who previously had been laboratory assistant, Studebaker Corp., South Bend, Ind., is now employed as an engineering draftsman by Allis-Chalmers Mfg. Co. in the Laporte, Ind. plant.

LT.-COL. PAUL G. HYKES, who had been a major stationed at the Defense Training Center, Mitchel Field, L. I., N. Y., may now be reached at A. P. O. 339, c/o Postmaster, New York City.

OBITUARIES

Donald J. Lowman

Donald J. Lowman, research engineer, Wright Aeronautical Corp., died April 11 at the age of 58 after several months' illness. Associated with experimental engine development at Wright since 1927, the year he joined the SAE, Mr. Lowman brought to this activity a wide range of mechanical experience previously acquired in over 15 years of engineering work with U. S. Steel and the American LaFrance Co. Under his guidance the J-6 series Whirlwinds and the C9, C14, and C18 Cyclones, all of which became world-famous as aircraft powerplants, were tested and developed. Mr. Lowman was a member of the SAE Ignition Research Committee.

SAE Vice-President Raymond W. Young declared that Mr. Lowman "personified by example the qualifications essential to experimental engineering."

Raymond Haskell

Dr. Raymond Haskell, 66, a member of the War Advisory Committee of the Coordinating Research Council, Inc., and consulting engineer for The Texas Co., died April 6 in New York. His home was in Summit, N. J. Soon after his graduation from M.I.T. in 1906, he joined the U. S. Lighthouse Service, becoming superintendent 10 years later. In 1918 he served as a civilian scientist for the Navy.

In 1919 he joined The Texas Co., and during the present war emergency has served as a liaison technologist between the Army and Navy and the Petroleum Industry War Council, spending much of his time in Washington. His degrees of M.Sc. and Ph.D. were also granted by M.I.T., and that of chemical engineering from Clarkson College, Potsdam, N. Y. He was elected a member of the SAE in 1934, and served on a number of the Society's research committees prior to the formation of CRC.

Walter L. Dixon, Jr.

Walter L. Dixon, Jr., vice-president and general manager of the Twin Disc Clutch Parts & Service of N. Y., Inc., and of Philadelphia, died on Feb. 25, at the age of 29.

Mr. Dixon had also been associated in the marine field as assistant chief engineer on commercial tuna boats on the West Coast. In 1935 he became associated with the Twin Disc Clutch Co., of Tulsa, Okla., in the sales and service department, and a year later he joined Spartan Aircraft Co. In 1938 he organized the Twin Disc Clutch Parts & Service of N. Y., Inc. Mr. Dixon was a native of Highland Park, N. J.

During this war, he spent much of his time with the various Navy and Coast Guard Depots assisting in selecting service and parts mortality lists for diesel marine reverse gears, hydraulic units, and heavy-duty industrial clutches as installed on many of the Navy landing craft and M-4 and M-5 tractors.

John F. Werder

John F. Werder, 46, president and chief engineer of the Zip Abrasive Co. of Cleveland since 1939, died on Feb. 28. Mr. Werder started the Zip Mfg. Co. in Denver as a partner, serving as general manager of sales and manufacturing. In 1922 he was named vice-president of the company when it became known as Zip Abrasive Co.

Samuel V. Krauthoff

Samuel V. Krauthoff, a colonel in the U. S. Army, died in the European Theater of War on Feb. 1. Col. Krauthoff was 42 years old.

Since his graduation from the U. S. Military Academy at West Point in 1924, Col. Krauthoff made his career in the Army. He had served in the Field Artillery in the United States, Hawaii, and in this war he served in Europe. Most of his efforts were devoted to fleet maintenance and operation of Army vehicles.

John A. Howlett

John A. Howlett, who had been general supervisor of service stations of Sears, Roebuck & Co., Chicago, died recently after a brief illness at the age of 59.

Mr. Howlett had been in the engineering field since 1908, when he joined the E. R. Thomas Motor Co. as a research engineer. In 1942 he was granted a leave of absence from Sears, Roebuck & Co. to serve in the U. S. Army Air Forces as a major.

Albert G. Lindenthal

Albert G. Lindenthal, owner of the Concord Buick Co., died Jan. 29 at the age of 50.

Mr. Lindenthal was graduated from the College of the City of N. Y. in 1914 with a B.S. degree. He became associated with the Buick Motor Co. of Flint, Mich., in 1919 as assistant engineer in the motor test laboratory where he specialized in dynamometer testing.

Mr. Lindenthal had been a member of the Society since 1919.

turn to p. 57

Technical IDEAS

SUPERCHARGER EFFICIENCIES

Cut by Pressure Drops In Induction Passages

by ARTHUR P. FRAAS
Packard Motor Car Co.

■ **1945 War Engineering-annual Meeting**

(Excerpts from paper entitled "Flow Characteristics of Induction Systems")

OF the several different types of possible losses in the supercharger induction passages, the most evident are pressure drops resulting from restrictions such as elbows, carburetors, screens, or other discontinuities. A second group much more difficult to determine are those losses resulting from the velocity distribution across the impeller eye.

A third type of loss is caused by prerotation in the air stream entering the impeller, which may reduce the capacity of the supercharger without affecting the efficiency.

Airflow Tests

Some very worthwhile tests can be made on a projected supercharger inlet passage arrangement by blowing air through a full-scale wood model. The air may be allowed to discharge freely to the atmosphere from the impeller eye and a pitot traverse made to check the air velocity distribution across that section. The total pressure drop across the model will give an indication of the pressure losses. If the velocity distribution across the impeller eye is good and the pressure drop reasonably low, a more extensive set of tests may be run in an air box, which permits the use of low-density air. A set-up of this sort is shown in Fig. 1.

Engine Airflow Requirements

In general, the position of the engine operating point shifts somewhat on the supercharger characteristic curves of compression ratio versus a flow factor.

As a first approximation, it may be assumed that for the full-throttle condition with any given supercharger gear ratio and engine speed, the manifold pressure is directly proportional to atmospheric pressure. Thus, the air density in any particular portion of the induction system may be taken as being directly proportional to the carburetor inlet air density if the rate of intercooling or aftercooling is held constant. On this basis, the volume of air passing through the engine will depend only on the engine speed and volumetric efficiency.

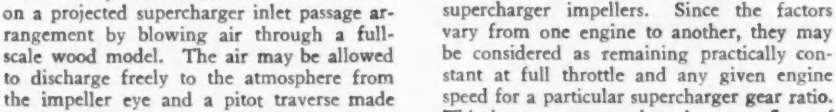
The decrease in manifold temperature with altitude causes the volumetric efficiency to fall off somewhat because of the increase in the temperature difference between the fresh charge and both cylinder walls and the residual exhaust gas. This tends to decrease the full-throttle volume flow as the temperature is decreased. The effect is practically balanced by the increase in supercharger compression ratio which accompanies a reduction in the air temperature in the supercharger impellers. Since the factors vary from one engine to another, they may be considered as remaining practically constant at full throttle and any given engine speed for a particular supercharger gear ratio. This in turn means that the mass flow of air through the engine should be directly proportional to the carburetor air inlet density.

The important points which must be kept in mind in the selection of an engine supercharger induction system may be summarized as follows:

1. The full-throttle volume flow of air through the engine increases with the amount of supercharging, but at any given supercharger speed and engine rpm, it is practically independent of altitude.

2. The pressure drop through a supercharger induction system will become excessive if local air velocities reach the sonic range. This means that allowance should be made for the effect of altitude temperatures on the velocity of sound if induction system tests are conducted at normal room temperature.

3. The loss in full-throttle engine performance chargeable to a particular supercharger induction system as expressed in terms of feet of altitude will increase with both engine and supercharger rpm. It will be independent of altitude unless local air velocities border on the sonic range at the lower altitudes. In that case, lower temperatures at higher altitudes may cause a serious increase in the induction system loss.



■ Fig. 1 – Schematic diagram of air-box test set-up

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Prolongs Service Of Transmissions

by R. R. BURKHALTER
Spicer Mfg. Corp.

■ **Pittsburgh, Oct. 1**

(Excerpts from paper entitled "Truck and Bus Transmissions")

TRANSMISSIONS, like other modern machinery, have many finely finished surfaces held to very limited tolerances, ball and roller bearings, and mating gear teeth manufactured with extreme accuracy which will provide many thousands of miles of satisfactory operation if reasonable care in operation and maintenance is provided.

The presence of foreign matter in transmissions is responsible for the largest percentage of failures. The term "foreign matter" is used to cover any substance detrimental to the transmission operation, whether introduced during maintenance or the result of faulty operation.

Failure usually starts in the bearings, either by excessive wear or complete bearing failure. This results in shaft misalignment with stress concentration on the ends of the gear teeth. Fatigue cracks, due to stress concentrations, soon appear and that portion of the gear tooth breaks out, entering one of the gear trains with disastrous results to transmission case and gears.

During operation and maintenance the

for ENGINEERS

Briefed from Papers Given at SAE Meetings

lowing rules should be observed to assure maximum life:

Parts should be thoroughly washed in clean kerosene or solvent and re-oiled before assembly.

Exposed parts should be covered with a clean paper or clean cloth to keep out dust if assembly is not to be completed at once.

Arbor presses and pullers should be used during assembly and disassembly whenever possible.

Watch for particles of metal from tubing or drifts used during assembly.

Lubricant containers should be clean. Adherence to recommended types of lubricants will assure freedom from corrosive additives. A good quality of lubricant, having a minimum tendency to carbonize, should be used.

It is the operator's responsibility to prevent chipped teeth by proper shifting without clashing.

Periodical clutch adjustment should be made as it is impossible to shift a transmission without clashing gears if the clutch drags.

Another item that should be called to the operator's attention is full engagement of mating gears. It is most common to see gears that have failed because the active tooth face of the gear has only been partially engaged, resulting in that portion of the gear absorbing the full load. This results in teeth worn on a taper or twisted teeth and a transmission that will not stay in gear or partially broken teeth or fatigue cracks at the base of the tooth due to concentrated loads, with complete tooth failure at a later date. Most transmissions require longer shift movements in first and reverse speeds, where sliding gears are used. Unequal length of shifts at the shift lever handle have been eliminated in our current transmissions by incorporating an equalizer lever in the control mechanism and this improvement has definitely reduced the number of failures caused by partially engaged gears.

The importance of transmission lubrication has increased with the higher speeds and use of constant-mesh gears.

The type of lubricant used should be carefully selected to the vehicle and transmission manufacturers' recommendations in order to take advantage of their accumulated records of research and field experience for the particular unit.

The development of the EP lubricants has made possible the quieter type of gears and additional floor clearance of the hypoid axle, but these units must be designed with special features to use EP lubricants and EP lubricants only.

★ ★ ★

ADDITIVES IMPROVE LUBRICANTS

by W. A. WRIGHT
Sun Oil Co.

▪ 1944 National Fuels and Lubricants Meeting

(Excerpts from paper entitled "A Survey of Past and Present Trends in Lubricating Oil Additives")

THE use of addition agents greatly extends the life of oil, as well as the useful life and mechanical condition of the operating equipment. The ability of lubricants to carry loads many times normal is achieved, and mechanical designs for very severe types of service become less difficult or more readily attainable.

The use of lubricant additives is old, but the period between 1930 and 1935 marks the beginning of activity in this field as we know it today. This is shown in Fig. 1. The marked rise in patents for various types of additives is in excellent agreement with actual usage in the industry. Of particular interest is the presence of prominent maxima and the declines immediately following, reasons for which are:

1. Effect of war.

2. Satisfaction as to adequacy of present products.

3. Probability that we have taken almost every possible compound off the shelf and are being hard pressed for more.

Examining a typical additive class in detail, Fig. 2 shows trends found for various types of antioxidants. For convenience, all nitrogen compounds of various types were grouped for purposes of plotting and similarly for the other types shown. There are numerous instances of cross indexing. For example, a compound containing both a sulfide and an amine appears under both types. Amines have probably been known as antioxidants for the longest period of time.

Sulfur compounds later became very prominent, and it would appear they have not yet passed their peak. Other types ap-

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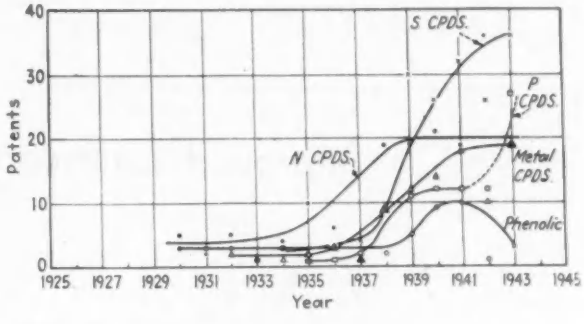


Fig. 1 – Number of oil additive patents versus date

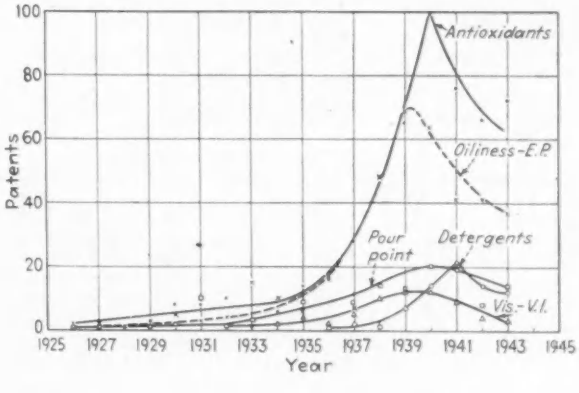


Fig. 2 – Number of antioxidants of various types versus date of patent

DETERGENT OILS ARE MEETING ARMY NEEDS

by CARL W. GEORGI
Quaker State Oil Refining Corp.

▪ 1944 National Fuels & Lubricants Meeting

(Excerpts from paper entitled "Detergency or Dispersancy in Heavy-Duty Engine Oils?")

ADDITIVE-treated oils for heavy-duty engine service of the type meeting the requirements of U. S. Army Specification 2-104B, have come to be known as "detergent oils." Oils of this type, containing oxidation and bearing corrosion inhibitors, and detergent additives are now widely recognized as being much superior to straight mineral oils for lubrication of engines in severe or difficult service.

Detergency, dictionary definitions indicate, tends to imply the property of cleaning out dirty engines, whereas dispersancy would indicate the property of maintaining insoluble matter (sludges and contaminants) in dispersion in the oil so that they will not settle out and ultimately build up as deposits.

The question, therefore, might be:

Is the function of heavy-duty, additive-treated oils to clean up and rejuvenate dirty engines or to maintain clean engines in clean condition for the maximum possible periods of operation? To evaluate more definitely these respective functions a series of laboratory and road tests were conducted over the past few years.

The test results indicate that the essential function of heavy-duty oils should be defined as dispersancy rather than detergency.

Although heavy-duty oils do display appreciable detergent properties on engine deposits of a soft, grease-like nature and on those parts of an engine where vigorous oil circulation and washing occurs, they are not effective cleansing agents for hard, adherent or baked deposits or in those engine sections where oil flow and attendant washing action are limited.

Furthermore, the detergent and loosening action of heavy-duty oils on soft sludges and deposits involves a serious hazard if adequate precautions are not taken. The sudden loosening of considerable amounts of sludges in badly fouled engines can readily cause plugging of oil pump intakes and disruption of oil circulation. Serious engine damage can then result if the condition is not noticed soon enough. A sufficient number of such failures have occurred in the field to make this a problem which cannot be ignored.

Although heavy-duty oils have become popularly known as "detergent oils," it appears that a more correct description should be "dispersant oils." While no great harm results from the somewhat inaccurate name "detergent oil," it does seem desirable to emphasize that the essential function of heavy-duty oils is to keep clean engines in clean condition for maximum periods of operation. Since the only thorough and safe means of cleaning a badly fouled engine is by disassembly and overhaul, it likewise seems desirable to emphasize that heavy-duty oils are not intended as cleaning or purging agents, even though the popular name "detergent oil" might imply this function.

The apparent ability of heavy-duty oils to loosen soft, pasty-type deposits from badly fouled engines, introduces a problem which may require serious consideration in post-war years. H. C. Mougey has predicted that heavy-duty oils will become more widely available and will be used extensively for general passenger-car engine lubrication when current restrictions on critical chemicals and additives are lifted.

The potential danger of sudden loosening of certain types of sludges when heavy-duty oils are first added to dirty engines is well recognized, and suitable precautions can be taken in most commercial fleet operations where there is some measure of control over engine maintenance and lubrication practices. In the case of passenger cars, where owners frequently use different types or brands of oil with almost every oil addition or refill, there is no control over engine condition and the sludge loosening proclivities of heavy-duty oils thus presents a more serious problem than has been the case to date, where use has been confined largely to controlled fleet operations.

Improved Lubricants

cont. from p. 33

pear to be leveling off, although it is possible that a highly successful structure might be developed in any one of these types which will start a wholly new trend. Examination of the literature and patent structure shows that the initial steps were often in terms of the relatively simple typical types of organic compounds. This was followed by a strong trend toward more complicated structures and permutations of the individuals.

Another development was the attempt to provide in one complicated compound a wide variety of additive properties in general, such as a compound which would have the ability to act as an antioxidant, load-carrying agent, pour point depressant and viscosity index improver. Compounds having at least a dual character are quite common and have been applied successfully.

The development of additives for various purposes is strongly influenced by the method of study and test. We are about to enter a period which will demand the utmost in our efforts, and improvement in method is seriously needed.

Our real need is an understanding of the mechanisms involved during service of a lubricant. Selecting oxidation as an example, we can outline the desirable state of stability as follows:

1. Oxidation stability (oxygen consumption)
   a. anti-acid } anticorrosion
   b. antiperoxide }
   c. antisludge
   d. antiresin (acids?)
   e. antiviscosity increase
2. High thermal stability
   a. resistance to cracking at high temperature
   b. low temperature coefficient of oxidation
3. Low catalytic susceptibility
   iron, copper, lead, silver, and cadmium
4. High oil solubility for oxidation products.

With some slight modifications depending on the particular type of service in mind, the above list represents an ideal general specification. Aside from the helpful effects of any additives, the various items are specifically related to constitution, mechanism, and condition of service.

Other additive studies, such as the fields of detergency and extreme pressure lubricants, are also in a timely position for more detailed work. Much remains to be done in clarifying the distinction between detergents and dispersants.

Lubricants of the future will be carefully formulated and highly specialized. While there will still be important techniques developed in the field of refining, much of the load will be borne by specialized addition agents. Those which we now rely upon will be improved greatly.

■ ■

Supercharging Doubles Power

by RICHARD HEROLD
Sulzer Bros., Ltd.

▪ Metropolitan, Nov. 9

(Excerpts from paper entitled "Supercharged Two-Stroke Cycle Diesels")

SUPERCHARGING is not limited to fast-running opposed-piston engines; it has been applied just as well to medium-speed single-piston engines. The range of bores investigated so far goes from 3½ to 22 in., the range of supercharging pressures from

tmospheric up to 85 psi abs. Mean effective pressures have been obtained which are ve pressures have been obtained which are twice or three times as high as those of tmospheric engines. Fig. 1 shows a bore f 3½ in., stroke 2x4¾ in., three horizontal pposed-piston cylinders (six pistons) on a ruck engine.

As supercharging pressure increases, the importance of blower and turbine increases oo. In the conventional engine, the scavnging compressor absorbs about 6 to 9% f the engine power. If the charging pressure is raised to 30 or 50 psi, the power bsorbed by the compressor may reach 25 o 40% of the engine output. A two-stage xial compressor with intercooler may have combined efficiency well above that of the wo stages. However, the two-stage arangement increases weight and price. Thus, he limits of supercharging may well be determined by economics rather than by hermodynamics.

In commercial practice, with supercharger fficiencies now available, Sulzer engines of igh output density are built with supercharging pressures of 28 to 40 psi abs, giving bmep 140 to 215 psi.

An engine supercharged to two atmospheres, or 28.4 psi, has an exhaust gas outlet pressure of 8.4 psi. The air inlet pressure to the cylinder and the pressure of the compressor are correspondingly higher, depending on scavenging efficiency and air conduit design. The inlet pressure of the exhaust gas turbine is practically identical with the supercharging pressure.

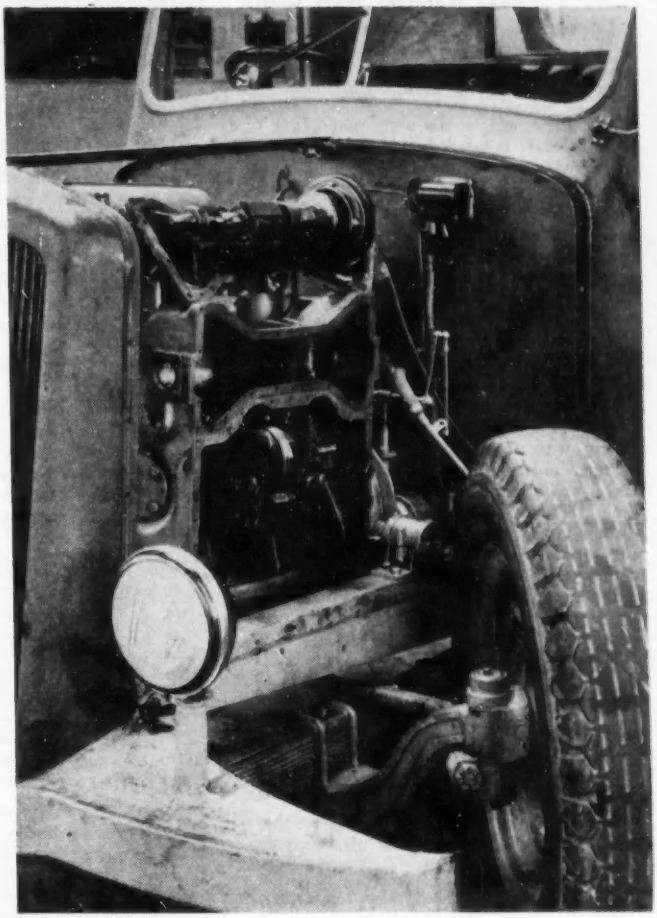
Raising the supercharging air pressure to 30 psi brought about the remarkable result of increasing the bmep by more than 100% —at which time it was logical to try still higher pressures. But, while a supercharging pressure twice as high as atmospheric raised the bmep to more than twice the unsupercharged value, the gain in bmep has been found to decrease as the charging pressure increases further. This is due to the limitations placed on engine operation by thermal stressing.

At supercharging pressures of 70 to 85 psi (depending on blower and turbine efficiency), the ever increasing power required by the blower becomes equal to that developed by the diesel. Power delivered by the turbine also becomes as high as that of the diesel. Therefore, it is immaterial whether it is the diesel or the turbine which drives the blower. If the blower is driven by the diesel, the turbine may well be detached from the group, as shown in Fig. 2, bottom. The turbine has thus become the producer of useful power.

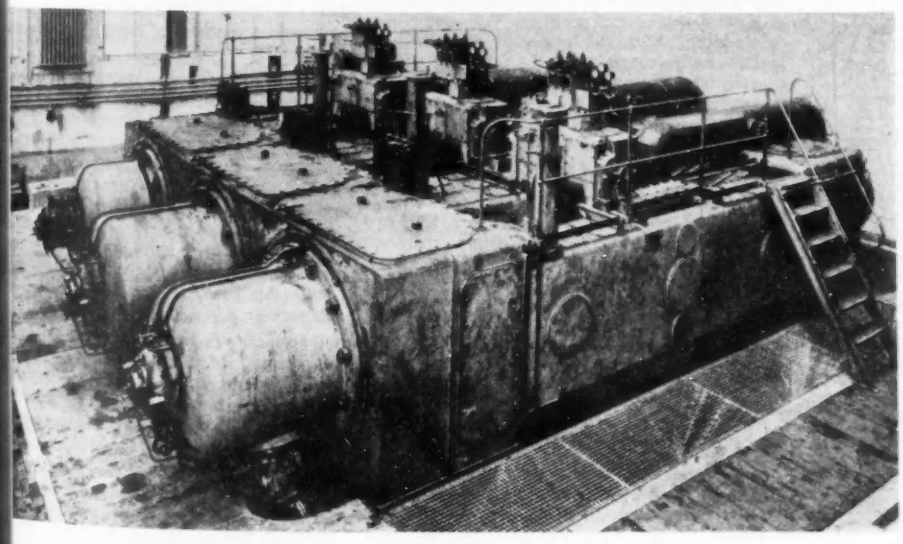
Free piston machines of small and large sizes have been tested for a number of years, and we now have a 7000 hp free-piston gas generator, seen in Fig. 2.

The free-piston diesel gas turbine opens the field of large marine plants to the diesel. Numerous diesel gas generators can feed one single turbine. For instance, eight 12-cyl generators of the present experimental type could feed four turbines in a 200,000 hp vessel. The vessel could develop full power almost instantaneously upon starting the plant. Ships could no longer be cornered, as at Oran or Pearl Harbor. Commercial vessels could cut their fuel bills in half.

Apart from the steam roller, the practical value of every vehicle is closely tied to the output density (or weight and size per unit of power) of its powerplant. This applies particularly to high-speed vehicles and airplanes. Thus, the most obvious field of application for the supercharged two-cycle diesel and the power gas process are indicated.



■ Fig. 1 (above) — Truck engine, opened, showing accessibility of crankshaft, fuel pump, walking beams, and pistons



■ Fig. 2 (left) — Sulzer 7000 hp free-piston power gas producer; 3-cyl, bore 15¾ in. (in the diesel part of the cylinders); normal load stroke 2x24 in.; 350 two-stroke cycles per min; turbocharger (pre - compressor) pressure 25.5 psi abs; diesel charging pressure above 85 psi abs

Design Features Make Plane Safe

by FRED E. WEICK
Engineering & Research Corp.

■ 1944 National West Coast Aeronautic Meeting

(Excerpts from paper entitled "Four Years of Simpler Flying with the Ercoupe")

THE Ercoupe is a low-wing monoplane of all-metal construction except for the fabric covering of the outer wing panels. The usual weight, dimensional, and performance figures for the airplane are given in Table 1.

In order to make the plane particularly suitable for the private owner by having it unusually easy and simple to fly, quick to learn to fly, and free from the dangers associated with stalling and spinning, three major unconventional design features were used. First, the airplane was made spin-proof and provided with effective lateral control at all speeds. Second, the control system was simplified by having both the ailerons and rudders linked to the control wheel, eliminating the rudder pedals entirely. Third, the tricycle landing gear was used, allowing the airplane to be landed at any speed up to twice the minimum speed without any tendency to leave the ground again after contact. This gear reduces the ordinary hazards of ground-looping or nosing-over.

Results of a four-year actual service test have indicated that the plane is simple and easy to fly because of the number of non-pilots who have handled the controls alone during their first ride in the plane.

Experience with Various Elements of Flight

Taxiing – Under ordinary field and weather conditions, taxiing and ground maneuvering can be accomplished almost without instruction beyond pointing out the throttle and brake handles and explaining their action.

If, when taxiing in an extremely high wind the plane should weathercock into the wind, improved traction and steering control can be obtained by keeping the control wheel forward, applying the brakes a small amount and turning the handle to lock them, if desired. With its stable tricycle landing gear and clear forward vision, the airplane can be taxied at high speed.

Taking Off – The start of the take-off run usually is made with the wheel in neutral or medium position. To take off from the ground it is necessary to increase the angle of attack of the wing by lowering the tail, which is done by moving the control wheel back gently after the minimum take-off speed has been exceeded by a comfortable margin.

Accidents during take-off have been of two types: those due to bad terrain and those involving collision with an object after the plane has left the ground. If the planes had substantially shorter take-off runs so the pilot could see the terrain over the entire take-off distance from the airplane before starting, such accidents might have been reduced.

Straight Flight – Without the possibility of crossing the aileron and rudder controls, flying a straight course properly has given no particular difficulty. In a side-by-side airplane with its off-center seating, it is often difficult to determine the exact position in which the plane is heading. As a minor aid to the pilot in this matter, a longitudinal sighting line is now being provided directly in front of each occupant on the top of the motor cowling or hood.

Turns – The main requirement in a turn is that the wing be banked so as to incline its lift to make the airplane change its course direction, and that with conventional controls the aileron is used to maintain the desired bank, the elevator to maintain the proper speed, and the rudder to keep the airplane flying a true course without slipping or skidding. With rudder pedals eliminated and the entire control made by means of the control wheel, coordination is automatically taken care of by the characteristics of the airplane, and there is no opportunity for the pilot to coordinate the aileron and rudder controls incorrectly.

Other Air Maneuvers – The ailerons of the Ercoupe are unusually powerful, for they are large and are deflected further than usual. Also, the elevator control, although limited in its upward travel, is sensitive and the airplane responds to it instantly. Thus, controllability and maneuverability of the airplane are exceptional.

Landing – There is no question that the tricycle landing gear simplifies the landing operation, largely because the airplane stays on the ground by itself even though it is landed at well above minimum speed.

Ground Handling – Personal airplanes such as the Ercoupe should be provided with good engine starters, preferably the electric starter with battery and engine-driven generator, if they are to be put into general use.

Comfort – The Ercoupe sliding window arrangement which provides instant choice of open or closed cockpit appears to be well liked. When protection from the sun is needed, an overhead sunshade window fitting in the same tracks as the regular windows has been provided.

Table 1 – Ercoupe Data

Full Load Weights and Performance	
Engine hp	65
Power Loading, lb per hp	19.4
Wing Loading, lb per sq ft	8.8
Empty Weight, lb	725
Useful Load, lb	535
Gross Weight, lb	1260
Baggage Allowance, lb	60
Fuel Capacity (Standard), gal	23
Fuel Consumption, Cruising, gph	4.6
Oil Capacity, qt	4
Oil Consumption, pt per hr	¾
Maximum Speed, mph	117
Cruising Range, miles	525
Service Ceiling, ft	13,000
Rate of Climb, First Minute, ft	700
Fuel Mileage, mpg	23
Dimensions	
Wing Area, sq ft	142.6
Chord, ft	5
Span, ft	30
Length	20 ft 9 in.
Height	5 ft 11 in.
Elevator Area, sq ft	9.4
Stabilizer, sq ft	10.2
Rudder Area (2), sq ft	6
Fin Area (2), sq ft	3.3
Aileron Area (2), sq ft	16.8

MOTOR TRUCKS . . . Can Use Either Diesel Or Otto Cycle Engines

by FRED B. LAUTZENHISER
International Harvester Co.

■ Southern Ohio, Jan.

(Excerpts from paper entitled "A Nontechnical Discussion of Diesel versus Gasoline Powerplants in Motor Trucks")

ADVANTAGES of Diesel as Compared to Otto Engine

1. *Fuel Economy* – The fuel economy of the present-day diesel is perhaps its outstanding advantage over the gasoline engine. The difference rarely runs under 20% on a pounds-per-brake-horsepower-hour basis and it may, under certain conditions of operation, run considerably higher. This, coupled with the fact that diesel fuel usually costs less than gasoline, means horsepower at the flywheel is developed by the diesel, as far as fuel is concerned, at a lower figure than by the gasoline engine. The diesel's outstanding advantage is that at part loads it is much more economical per horsepower-hour than a similar size gasoline engine.

2. *Fuel Variety* – Like the gasoline engine, the diesel works best when the fuel variations are held within reasonably close limits. It does, however, use a wider variety of fuel oil successfully than does the equivalent gasoline powerplant.

3. *Efficiency* – Generally speaking, the diesel ranks as the most efficient of all internal-combustion engines and uses the most direct method of transforming chemical energy into mechanical energy that has been developed.

4. *Fire Hazard* – Modern trucks are all designed to provide a maximum safeguard against fire hazard. However, most trucks use gasoline which is admittedly highly inflammable. Poor maintenance and careless operation of such trucks always present the possibility of loss by fire. The diesel, on the other hand, does not present this hazard because diesel fuel is not highly inflammable. In numerous operations which present highly inflammable surroundings, this advantage is greatly to be desired.

5. *Service Troubles* – Two sources of maintenance difficulty which demand the greatest attention of most service men – namely, the ignition system and the carburetor of the gasoline engine – are totally lacking in the diesel.

6. *Better Distribution* – Another advantage of the diesel is a better distribution and a more uniform burning of fuel mixture

ecause here the fuel is metered in equal mounts into each separate cylinder.

7. *Longer Period of Expansion* – Due to e slower burning of the fuel oil in the esel combustion chamber, there is a longer riod of expansion and it is, therefore, sumed to provide greater lugging ability an the gasoline engine.

Disadvantages of the Diesel

Among the disadvantages of the diesel gine are:

1. *Higher Initial Cost* – So far the diesel gine has been inherently costly, primarily ecause of its precision-built injection sys-m, its greater weight per brake horsepower nd because but a relatively small number f units is produced annually. The quantity volved does not yet at least permit the mplete retooling of factories necessary to w-cost production.

2. *Greater Weight* – So far at least, the tomotive diesel has had to be heavier to thstand the stresses imposed during its cle of operation by the high compression nd explosion pressures. The engine is made avy to provide satisfactory factors of safety r the stresses imposed with full power eveloped, and the heavy parts thus limit e rpm, with the result that the weight per orsepower is relatively high.

3. *More Noise* – In comparison with the asoline engine, some diesels are quite noisy nd rough in operation.

4. *More Smoke* – One of the difficulties which has beset designers since the early days of the diesels is a smoky exhaust. As more and more is learned regarding the technique of getting the fuel into the combustion chamber and properly burning it, the problem of smoke will probably be greatly reduced.

5. *Odor* – The odor of diesel-powered trucks is not objectionable in the open country. However, in cities the odor certainly is an objection.

6. *Engine Size* – The diesel is at a disadvantage in that for a power output, a gasoline engine can usually be confined to less weight and to a considerably smaller space.

7. *Higher Cost of Service and Parts* – It is true that not as many skilled mechanics are familiar with the diesel as with the gasoline engine. Therefore, generally speaking, a good diesel man commands a higher wage. This objection to the diesel does not apply to the factory-owned service station or to fleets having their own service departments.

8. *Difficult Starting* – A diesel engine usually is more difficult to start than a gasoline engine. This is due principally to the high compression pressure. Most diesels use from 12- to 24-v storage batteries in high-torque starting motors. Subzero temperatures add to these difficulties.

9. *More Vibration* – Due to high compression and explosion pressures and larger and heavier reciprocating parts, there is considerably more vibration in a diesel than in a gasoline engine.

10. *Lubrication Problem* – A lubrication problem is involved because products of combustion are driven past the piston rings and contaminate the oil.

11. *Fuel Filters and Frequent Cleaning Necessary* – The fuel used in diesel engines should be carefully filtered in order to eliminate all dust and foreign matter from the fuel oil before it enters the fuel pump. Dirty fuel could cause sticking of the closely fitted parts in the fuel injection pump, nozzles, and valves, and does cause wear and scoring of plungers.

12. *Less Flexibility of Speed* – Due to the heavier reciprocating parts, the speed of some diesel engines is not as flexible, and so does not respond to the throttle as quickly as a gasoline engine.

It will be noted from the list of disadvantages that there are a number of annoyances in a diesel, such as smoke, odor, vibration, hard starting, and so forth, that are not present in a gasoline engine. The fact remains, however, that when the only consideration is that of saving in fuel and operating cost, as shown by some of the foregoing, the operator is willing to sacrifice to some of these annoyances and discomforts.

The next few years will doubtless see many improvements in diesel-engine design and these should eliminate, to a great extent, most of the objectionable features.

Permanent-Mold Castings Expedite War Production

by L. F. SWOBODA
Aluminum Co. of America

1944 National Aeronautic Meeting

(Excerpts from paper entitled "Advantages and Characteristics of Light-Metal Permanent-Mold Castings")

THE remarkable service which light-metal castings have provided in various war applications can be attributed in no small way to the development and improvement of the permanent-mold casting process. Aluminum and magnesium alloys, in the form of permanent-mold castings, have contributed to increasing the speed, efficiency, and range of our fighters and bombers. Light-metal alloy landing and tail wheels plus numerous engine and airframe parts have helped to reduce the weight of warplanes and improve their operating performance. Naturally, these uses represent only a fraction of the light-metal permanent-mold castings which are employed in our war equipment. They are, however, indicative of the quality and usefulness of these light-metal products.

There are many potential advantages afforded by the combination of the permanent-mold process and the light-metal alloys. Too frequently, however, the advantages are not completely realized, because the buyer fails to consult the supplier in the early stages of his design. To develop the most economical and practical design, it is essential that the buyer and the foundry cooperate from the beginning by discussing all features, such as design details, available alloys, and service requirements.

The process of permanent-mold casting consists of pouring molten metal into a hot metal mold or die. It differs from the die casting process, in that the metal is fed into a hot-mold cavity by the force of gravity rather than into a water-cooled die by pressure. A variation in the permanent-mold process is also frequently employed and greatly expands the use of the permanent-mold process. It consists of using a dry sand core for the interior surfaces and a metal mold for the exterior surfaces. The semi-permanent-mold method is used when it is impossible to remove steel or iron cores from the interior of the finished casting. It may also be used when a smoother surface is required on the exterior than could be obtained if the part were made as a sand casting. Furthermore, by the semi-permanent-mold method most of the metallurgical advantages of the permanent-mold process can be obtained even though dry sand cores have to be used in part.

Castings made by the permanent-mold process have many advantages, the most outstanding of which is their metallurgical superiority over other cast products. If the metal is correctly poured into a properly designed mold (assuming the casting is well designed for the process), solidification takes place progressively; that is, the part of the casting farthest removed from the sprue and risers solidifies first and is fed by the successive additions of molten metal as the mold is filled. It is this progressive feeding of the casting, together with the rapid chill the metal receives on coming in contact with the metal mold, that produces a dense, fine-grained metal, the mechanical properties of which are substantially higher than those obtained in other types of castings. Furthermore, the physical properties are also enhanced by the fact that well-designed permanent-mold castings are unusually free from the more common foundry defects, such as dross, air pockets, and porosity.

The general soundness of permanent-mold castings also reduces the losses resulting from foundry defects which may be uncovered during the machining and finishing operations. It is frequently found that the amount of finish necessary for machining may be reduced below that required for sand castings, and since the essential surfaces of the casting can be made smooth, for many purposes finishing operations may be eliminated. As the result of the smoothness and accuracy possible with the permanent-mold process, many holes can be cored to size, thereby eliminating this machine operation entirely.

Pressure tightness is another advantage which is inherent in permanent-mold castings. This quality is often the determining factor in selecting permanent-mold castings rather than sand castings for a specific application.

Permanent-mold castings are not precision

products and, consequently, certain tolerances cannot be held too closely. Their dimensional accuracy, however, is intermediate between that of sand castings and die castings, especially when a fairly large portion of the surface is in contact with sand.

There are a number of important factors which should be considered during the design of light-metal permanent-mold castings. One of the chief requirements in the design of permanent-mold castings is to allow for the withdrawal of cores from the casting and the removal of the casting itself from the mold. In some instances, the castings are of an inherent design which cannot be changed sufficiently to permit the use of a solid core. For this class of castings, it is necessary that split cores, multiple-piece molds, or sand cores be used. In other cases, however, a permissible change in design will make possible the use of a single-piece core, thereby reducing the production costs.

When castings are being designed to facilitate their production, the designer should strive for a minimum number of cores, since their replacement in the mold requires more handling and slows down production speed. To minimize maintenance cost, extremely long, thin cores should be avoided whenever possible. Furthermore, the number of mold parts should be as small as possible, since speed of operation is valuable in maintaining proper mold temperature.

It is necessary for the supplier's designer to know where the jig spots are located. The marking of jigging points on the blueprint will aid the mold designer in placing parting lines, gates, and risers. In addition, the designer should know the exact position of the buyer's locating points so that both the supplier and buyer will check the accuracy of the casting from the same spots.

It is sometimes found desirable to cast inserts of other metals in light-metal permanent-mold castings. Since the light-metal alloys have different coefficients of expansion from other metals, a definite foundry technique is required for the economical and proper use of inserts.

Wherever practicable, uniform sections should be maintained throughout a permanent-mold casting. Section uniformity helps not only to simplify the gating and feeding problem, but also to equalize the rate of solidification, a very important factor in controlling the quality of permanent-mold castings. With any kind of cast product, when sections vary in thickness, there is a tendency to set up internal strains in the casting and cause non-uniform solidification, which may lead to shrinkage and cracking. In a design where light and heavy sections join, a gradual increase in thickness of the thinner section toward the point of junction will help considerably. In service, this blending assists in distributing loads over a larger area of the casting and thereby frequently eliminates undesirable stress concentrations.

The minimum section thickness possible in light-metal permanent-mold castings depends very materially on the size, pressure requirements, and intricacy of the casting. In general, however, the minimum section thickness which can be cast in permanent molds is approximately ⅛ in. When extremely thin sections are required, however, it may be necessary to make an engineering compromise since it is necessary to sacrifice some smoothness of surface to attain the desired thinness.

Limitations on section thickness also apply to the design of ribs in light-metal permanent-mold castings. Particular attention should be given to thin ribs, particularly those which are highly stressed. Their rapid cooling in the mold may set up casting strains which result in a lowering of the strength of the casting and possibly in cracks. In service, thin ribs may be points of failure, particularly when they are subjected to tension loads. For purposes of minimizing the danger of cracking, the edges of ribs should be blunt, rather than "full round."

The designer should provide generous fillets at all wall intersections in a permanent-mold casting to help prevent shrinkage and cracking at these points. Sharp internal corners constitute a source of weakness in castings and should be avoided wherever possible. Likewise, special care must be taken to provide generous fillets where ribs join the supporting faces of the casting, as it is in such sections that many foundry defects occur.

The use of multiple-piece and dry sand cores broadens the scope of the permanent-mold process and makes possible the production of some castings that could not otherwise be made by this method. If the "undercut" which necessitates multiple-piece cores can be eliminated, however, a saving in cost will result.

The amount of machine-finish allowance necessary for permanent-mold castings will usually be less than that for sand castings. Naturally, larger castings will require more allowance than smaller ones.

Seek Faster Methods of Handling Air Transport Cargo and Baggage

by C. L. MOON
Mechanical Handling Systems, Inc.

1944 National Air Cargo Meeting

(Excerpts from paper entitled "Mechanical Handling of Airplane Cargos")

THE problem of providing a quick, economical means of handling baggage and cargo is not easy to solve, but there are several methods which may accomplish the desired results:

The first arrangement is in successful use in many express terminals, shell loading plants, and large warehouses. The equipment consists of racks or trucks operating on track or floor and is provided with a means of attachment to a so-called "monoveyor" or trolley conveyor. The monoveyor has an I-beam track on which frequently spaced trolleys operate, supporting and being propelled by a continuous strand of chain which is driven by a mechanical drive.

The monoveyor may follow almost any required path, as direction changes may be made in both the horizontal and vertical planes. Proper operating speed should not exceed 150 fpm to avoid unwarranted wear on chain, track and trolleys and also to avoid difficulties in engaging and disengaging the trucks. A length of 6 to 8 ft with a width of 3 to 4 ft and a height to the top carrying deck of not over 5 ft 6 in. is about the correct size for the trucks.

The layout of the monoveyor would be determined by the arrangement of the cargo areas in the terminal building and by the number of plane loading spaces it must service. Trucks would be loaded with the cargo scheduled to go on a particular flight and the signal set to indicate the flight, and as the plane approached the loading point the truck would be engaged with the monoveyor and proceed to the loading point. Here it would be disengaged and moved manually out of the path of movement to the most convenient unloading position and the packages removed and placed on portable, elevating belt conveyors which have been placed in position against the plane at the proper height and location for each cargo door.

Unloading of incoming cargo would be a reverse procedure, with trucks dispatched to the proper unloading area, cargo unloaded onto the belt conveyor, and with movement controlled from the ground end. After the cargo is on the truck, it is dispatched with the proper identifying mark to the terminal building where it is unloaded.

Start and stop push buttons should be provided, one each for each transfer point, so interconnected that the monoveyor could only be started by use of the same button which stopped it.

The second method is generally known as the electric dispatch system. This consists of monorails with necessary switches, spur lines, and sidings on which an electrically operated power unit operates, towing one or more carriers suspended from trolleys which also operate on the monorail. Like the monoveyor, this system has proved its practicability.

For an air terminal installation, the system would consist of a main line of track connecting the cargo areas in the terminal to the loading areas outside, forming a closed track layout. Switches would be installed in the track where necessary for storage or racks, and at each such point there would be a stub or siding track of sufficient length to hold the power unit and one or more carriers. After the carriers have cleared the switch, it would return to its normal or closed position with relation to the main line. Operation of this type of system as used for handling air cargo at terminal would be about the same as for the monoveyor, except the carriers would remain suspended from the track.

The third type of equipment is termed the monoveyor pusher line, which consists of a monoveyor teamed with a monorail. Carriers are suspended from trolleys which operate on the monorail track and the carriers have arms extending horizontally which are engaged by pusher dogs attached at suitable intervals to the monoveyor trolleys and extending downward. The monorail may continue parallel to the monoveyor in the position where the engagement is maintained, or it may be offset at certain points to disengage the contact between the pusher arms and dogs. Here the motion of the rack stops and it may be loaded or unloaded.

...en manually pushed back into contact with the dog.

The layout of this system would be much the same as for the electric dispatch system, but includes the monoveyor. There would be a double loop line with the monorail loop in the outside of the monoveyor and with switches in the monorail track leading to stub lines, sidings, or offsets. Operation in practice would also be much the same except that there would be the necessity of manually operating the switches and moving the racks onto the nonpowered loading lines in order to clear the main lines.

The fourth scheme is almost identical with the electric dispatch system except that the cargo would be carried on cars operating on floor-level trackage. A power towing unit would be used in hauling the cargo cars. This has an advantage over the suspended system because there will be no overhead track or supports, cars will be more stable than the suspended carriers and can be built to carry heavier and larger loads. For small terminals where air cargo is light, one or more inclined belt conveyors can adequately take care of the requirements.

These conveyors should be constructed of light-weight materials with the main weight carried on rubber-tired, automobile-size wheels with antifriction bearings and with both ends adjustable as to height. A start and stop button, a belt with friction carrying surface, and a wheel brake should be provided for the conveyor.

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...AIR TRANSPORT Preparing for Boom After War's Ending

by D. R. PARVIN
United Air Lines

■ **Oregon, Jan. 5**

(Excerpts from paper entitled "What About the Age of Flight?")

UNITED AIR LINES' analysis of future air transportation indicates that the volume of domestic air transportation within four years after the war should show a five times expansion over 1941, the industry's best pre-war year.

Soon after the war United Air Lines will place in service a large number of 4-engined Mainliners to supplement the present fleet of twin-engined, 21-passenger transports. These transports will be of two types: the first will be equipped with 1450-hp engines and will maintain a cruising speed of 240 mph, accommodating a maximum of 44 passengers; the second will be equipped with 2100-hp engines, with a high cruising speed of 300 mph, and will accommodate a maximum of 56 passengers. Both planes will be sleeper and day plane types.

Reduction in transportation time is an outstanding feature of the faster 4-engined Mainliner particularly – it permits a businessman to leave New York at midnight, have a good sleep, and arrive in Los Angeles, San Francisco, Seattle, or Portland before nine the next morning.

Exhaustive research has led to the conclusion that there will be four possible types of planes in use five years after the war. They are:

A 100-passenger, 70-ton, 4-engined, low-wing monoplane designed primarily for long-range, deluxe passenger service. It will have a supercharged cabin and will fly at the higher altitudes of the substratosphere. Passenger accommodations will be decidedly luxurious.

The second type is a moderate range, 4-engined passenger plane of the low-wing type, weighing around 35 tons, and accommodating up to 75 passengers. This will be used for intercity flights and coast-to-coast schedules with frequent stops, and will be equipped with a supercharged cabin for high-altitude flying.

The third type may be called a "variable" carrier, in that it will accommodate either passengers or cargo or both. This is accomplished by using a quickly adjustable bulkhead separating passengers from cargo. It is a 20-ton, high-wing monoplane of the twin-engined type, having a moderate cruising speed of 212 mph. A maximum of 52 passengers or 14,000 lb of cargo can be accommodated.

As the air cargo field expands, a fourth type – specially designed cargo carrier – will be required. It will be a high-wing type, of about 15 tons, carrying over five tons of cargo at cruising speed of 210 mph.

Engines of planes used immediately after the war will be the familiar and dependable aircooled type, but they will be capable of delivering much higher powers than the engines of today.

The helicopter and jet-propulsion planes are still in the experimental stage, and the real prospects for their future are still not known.

Airports will continue to grow in size. As transport planes become larger and heavier, and as complete instrument landing facilities are developed, longer runways will become necessary. As traffic increases, multiple runways will be required, permitting simultaneous arrivals and departures.

Airports will be brought nearer to the center of business, in time, and this will be accomplished by high-speed, nonstop highways direct from the center of the city to the airport terminal building.

Future terminal equipment must be so designed that regardless of airplane size, complete transfer, loading and unloading can be accomplished in five minutes. Movable ramps, conveyor systems, and hoist trucks for elevated loading are some of the developments which will aid in saving time.

The market for post-war air transportation obviously will depend to some degree on passenger and cargo rates. It is recognized, however, that air fares must go lower if air transportation is effectively to penetrate the railway coach and bus travel market. Though the day will come when air transportation can compete on a cost basis with cheaper forms of surface transportation, rate reductions are not anticipated during the five-year period following the war.

While the development of air cargo undoubtedly will be great, studies indicate that the bulk of air transport revenue during the next few years will come from passenger traffic.

A projection of trend curves leads to fantastic expectations of future growth, indicating a 30 times increase in domestic air transportation within about 20 years. Though this may be possible, and not probable, the industry nonetheless has shown its confidence in the future by undertaking new financing and planning large expansion programs which await only the war's end.

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Plan Conversion of Military Planes to Air Cargo Services

by JAMES W. CLYNE
Douglas Aircraft Co., Inc.

■ **Kansas City, Nov. 16**

(Excerpts from paper entitled "Converting Military Aircraft for Commercial Use")

THE answer to the question as to whether we should attempt to use military cargo planes or if we should scrap them in favor of new airplanes specifically designed for commercial use depends upon the following factors:

1. Availability date of converted airplanes as compared with the availability date of new airplanes.

2. The number of airplanes that will be available for conversion.

3. The price at which surplus military cargo planes will be sold or leased for use by the operator.

4. The cost of operating the converted airplanes.

In considering the first point, it is safe to say that surplus military planes will be available for disposal by the Government before newly designed commercial airplanes can be produced.

Regarding the number of airplanes available for conversion, many thousands of large, twin-engined type, cargo planes have

AIR CARGO

cont. from p. 39

been produced. If only 5% of the total production in the last four years were available for conversion, there would be more planes available than are now operated by all the airlines in commercial service in the United States.

The third factor covering cost of equipment to the operator involves a total of three costs: the original fabrication cost of the airplane less depreciation, which is the basic cost; cost of converting the aircraft from the military to the commercial version; and cost of overhauling or replacing worn or damaged units.

In considering the basic cost, it is necessary to establish a basic price preferably for a new airplane and then provide for a reduction in price for used airplanes depending upon the number of flying hours, age, and condition of each individual airplane. This final determination of basic price will be made by the Government and will be predicated upon the initial cost of equipment to the Government.

The cost of conversion will depend upon the extent of the conversion to be accomplished. While the length of time the airplane has been in service will have a direct bearing on the amount of overhaul work which has to be done, it does not necessarily determine the amount of conversion work which must be accomplished.

The cost of overhaul will depend upon the length of time the airplane has been in service and the type of maintenance to which it has been subjected.

Factor number four concerns direct costs of operating the converted airplanes. These costs will vary depending upon the model of airplane converted, but the direct operating costs of converted airplanes of the same model should be reasonably close, provided the total costs of the airplanes are the same.

We have found factors one and two favorable to conversion due to the time element and also the number of planes available. However, in looking at factors three and four, we note that there are apt to be wide variations in costs between converted planes of different models as well as converted planes of the same model. Thus, we are led to conclude that before converting military aircraft, the economics of the situation should first be evaluated with respect to the specific airplane. If this results in an unfavorable picture, availability should be the deciding factor.

Considering the question of how we should convert airplanes which it is found practical to convert, not only must the model of the plane to be changed over be known, but a specification covering the final product must be written. Having determined what the airplane is composed of, it is a relatively easy matter to establish what is wanted in the airplane for commercial use.

Once the specifications have been determined, the work of engineering the conversion portion of the work begins. This is generally undertaken by first providing for the removal of the military equipment which is not needed in the finished version.

The next step involves scheduling the work in order to provide for the necessary manpower and facilities to accomplish the conversion and necessary overhaul. The rate of conversion, as well as the cost, is going to be dependent mainly on two items: tooling which is available and manpower which is used.

Careful planning must be done in providing tooling in the necessary quantity to accomplish the fabrication of the conversion parts. Though fabrication of the tooling itself is not difficult, it does require time and skilled manpower.

The next and final step is certificating the airplane for commercial airline operation. If the airplane is very similar to a commercial model which has previously been certificated, it is probable that flight tests made to comply with Civil Aeronautics Administration performance requirements will be of short duration. However, if the plane has no counterpart which has previously been certified for airline operation, it will probably be necessary to conduct very complete qualitative and quantitative flight tests.

In order for there to be no delays when equipment is finally released, it is necessary that the industry be supplied with answers to each of the following questions: When will military cargo airplanes be available for conversion? How many of each model will be available? What is the basic price? Under what conditions and terms will airplanes be made available and to what agencies will they be made available?

Compact, Multi-Purpose Car Radios Available after War

by JOHN H. LITTLE
Chevrolet Division, GMC

Detroit, Dec. 4

(Excerpts from paper entitled "Trends in Automobile Radio")

WHEN the first automobile radio sets came out, sales were few, but the 1935 sales were about 35% of the new cars sold, and in 1941 sales of car radios had reached a figure of about 2,000,000 units, which represented 53% of the new car sales. In dollars and cents, car radio had become big business.

A few years before the war, the stage had been reached where radio sets were completely housed in one unit, enclosing all the component parts, the controls and the speaker. These were usually mounted in the center of the instrument panel in a space provided by production. Along with some of these receivers came the use of steering column control, which permitted turning on the radio, adjusting the volume and selecting five stations in consecutive order by the use of a single knob without removing hands from the steering wheel.

During this development, performance of the car radio receivers had been improved to the point where they are now being made to a degree of sensitivity which is considered near the maximum that is usable.

In 1940, car sets were introduced which were a combination of the standard broadcast band and four international short wave bands. In those sections of the country where reception from standard broadcast band stations is impossible, a good many short wave stations can be received. Reception on short wave bands is also considerably less susceptible to interference from static type of noise.

Just before the war, frequency modulated broadcasting came into limited use, but there were no commercially available car radios which would permit the reception of FM broadcasting. Strong advocates for this type of broadcasting claim for it high fidelity and noise free reception – however, reception is not entirely free from noise, and high fidelity is possible with amplitude modulated type of broadcasting except that as the standard broadcast band is constituted now, station allotments are such that there is not enough frequency separation between the adjacent stations to permit its use. If amplitude modulated stations could be separated sufficiently in frequency, then high fidelity transmission would be possible.

It has been possible to provide some means for suppressing the interference resulting from the car's ignition system and generator system, but there is another form of disturbance, created by the car itself, for which no satisfactory solution is yet available. This is called tire static, and can be so annoying as to entirely drown out reception. The means for combating this interference have been to provide a better current conducting path between the wheels of the car and the chassis, rather than to make it necessary for the static charge developed on the tires to find its way to the chassis and body of the car through the oil film in the axles. A powder has been developed which can be used inside the tire tube, and which has considerably reduced the disturbance.

Interference from atmospheric static is well known, but so far there seems to be no solution for its elimination.

There also exists forms of man-made interference such as emanates from power lines, street cars and other electrical devices. The most satisfactory way of squelching this form of disturbance is to eliminate it at its source.

The future development of car radio, as has been in the past, will be toward more compact sets as space is at a premium in a motor car. This will be particularly necessary if additional performance in radio sets is desired of a character that can only be obtained by more component parts.

We feel that standard broadcast bands, international short wave bands and FM all have a place in the car radio picture, and future sets will undoubtedly take the form of combinations of two or three of these particular types of broadcasting.

Using the radio as a means of traffic control as well as television are also future possibilities.

Special-Purpose Greases Serving Novel War Needs

by C. W. BOHMER, JR.
Standard Oil Co. of N. J.

▪ **Southern New England, March 7**

(Excerpts from paper entitled "Warring with Petroleum")

ONE factor in the tremendous output of shipyards in this war has been the development of launching greases. The ship is built on keel blocks, and later the ways are laid down, greased, and a launching cradle is built up under the ship.

Grease coat on the ways consists of a base coat of very hard grease, built up in layers to serve as a protection to the ways. This is covered with a slip coat, a soft slippery grease used to lubricate and reduce the friction of the cradle on the ways. Greases must stand the extremes of temperatures, from below zero to over 100 F and still maintain the proper lubrication. With modern base coats, they may be used as many as 15 times, each time by simply applying a new slip coat.

"Invasion" grease, developed and produced in nine days for the invasion of Sicily, is applied to all parts of the engine as a water seal. It is molded like putty around spark plugs, distributors, and other parts of the engine. The engine intake, exhaust and fuel tank vent are all provided with pipes extending above the expected water level. This grease must have a number of unusual properties, it must be resistant to water and heat, not too sticky since it must be molded by hand, and it must have high dielectric strength. It is filled with asbestos fiber.

Low temperature greases have been developed for aircraft because of the range of temperatures that they are required to withstand. In spite of high ground temperatures, at high altitude the thermometer may fall to −50 F or lower.

An Army-Navy standard, AN-G-3A, has been established for low temperature grease. This states that a 204 Conrad 8-ball bearing at −67 F under a 2000 g-cm torque must make one revolution in 15 sec or less. This amounts to a power of 11 x 10^{-5} hp. However, two greases apparently equal on this basis may be quite different due to varying rates of evaporation at high temperatures on the ground.

Fire as an instrument of war is almost as old as war itself. The Chemical Warfare Department has developed the oil type incendiary bomb by adding a thickener to the petroleum base to make it stick to whatever it contacts. It looks like a hexagonal water pipe, weighs 6 lb with 2.5 lb of incendiary fuel. On impact, an inertia fuse sets off a 3 to 5 sec powder train which in turn ignites a magnesium charge that throws the flaming sock of fuel as much as 100 yd where it sticks and burns. The bomb has no fins—it is directed and slowed down to its optimum speed by a cloth tail. As many as 60 bombs may be dropped in one cluster. The oil type bomb burns longer and less intensely than the magnesium type.

Flame throwers were not too effective in the last war and at the start of this war, principally because their fuel was a liquid and burned itself out almost before striking its target. The present weapon, known as the "GI Hotfoot" in the South Pacific, uses the same fuel as the oil type incendiary. It has a range of 150 to 160 ft and hits the target with 70% of its fuel yet to be burned. It can shoot around corners by caroming the charge off from a rock or the like. The thrower consists of a suitable nozzle with fuel tank and tank for compressed gas for propelling the charge. It is fired in 2 sec squirts with about the accuracy of a garden hose.

This discussion has been a trip by water, land and air. It has tried to bring out the interdependence between the petroleum industry and the industries it serves.

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Uses Demand Design For Thermoplastics

by RUSSELL M. HOUGHTON
Air Technical Service Command

▪ **1944 National West Coast Aeronautic Meeting**

(Excerpts from paper entitled "The Development and Use of Plastic Materials for Aircraft Construction")

THERMOPLASTICS have been used over a long period of time in aircraft construction for windows, gun sighting panels, and similar applications where their optical characteristics and light weight are required.

The difficulties in service with these materials have been considerable. Methyl methacrylate is notch sensitive, crazes, and has poor abrasion resistance as compared to glass. In spite of their defects, however, it is necessary to use these materials. In designing, utmost care should be used in the selection of the method of mounting. Holes should not be drilled in the material if the design will permit the use of glued rubber bearing plates and metal extrusions or clamps. Much better stress distribution is obtained by this method.

The trend to complicated electrical systems in combat aircraft not only for power distribution but also for high-frequency systems has put more emphasis on insulating materials because they constitute an indispensable part of the conductor technique. In all these applications, the effects of high relative humidities and high and low temperatures are limiting design factors. All organic insulating materials based on carbon have, unfortunately, severe limitations as to thermal stability. The replacement of carbon by silicon has been shown to increase resistance to thermal decomposition and opens up a number of interesting possibilities.

Thermosetting plastic parts used in aircraft construction are produced by molding, laminating, or by mechanical working of plates, tubes, or bars. A large number of parts are now being produced by post-forming laminated sheets.

High impact stresses and strong deformation should be avoided with thermosetting molded parts produced with such fillers as wood-flour. Linear thermal expansion of molded parts is two to four times that of light alloys and steel. Thus, connections and molded inserts must be properly designed. The addition of chopped fibers, chopped fabrics, cord, and woven fabrics enhances the properties of synthetic resin to a point where their use may be considered for primary and secondary structural applications.

Use of Plastics

Plastic materials, because they are inherently light, offer possibilities for double-skin construction and have been used experimentally for that purpose. The next few years should see the gradual development of double-skin construction since it represents the most efficient use of the material in bending and shear, as compared with sheet-stringer construction. The trend in production is also in this direction, as it is desirable to eliminate the use of a large number of separate parts.

The use of plastic materials for such parts as droppable fuel tanks, ignition parts, flooring, instrument cases, insulation, propellers, and innumerable others is well known.

Today, it is necessary that there be close cooperation between scientist and technologist for a better understanding of the advantages and restrictions of the processes or materials employed.

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California Plans An Aerial Future

by W. F. CARROLL
Civil Aeronautics Administration

▪ **Southern California, Jan. 11**

(Excerpts from paper entitled "Airports in Southern California")

WHAT is the airport picture, present and future, in Southern California? California, in aviation, is known as the 10% state. Over a period of years 10% of the nation's aircraft has been home based in the state, and 10% of the registered pilots in the country have been residents of California. This means that after the war we shall have to provide airport facilities for 30,000 home based aircraft within the state; half of these will be in Southern California. If we add to that figure the prospective tourists and visitors who may come to California in their own planes, a real picture of our airport needs develops.

Today there are 80 airports in the 10 Southern California counties, and 150 are needed according to estimates. All of the designated landing areas are filled with aircraft and individuals are combing this area for new sites.

How shall we deal with this problem in Southern California? A state aviation com-

...ion, probably of a voluntary nature, could well be created, to which a state aviation director would be responsible. In this commission could be placed the problems of coordinating the plans and proposals of the various county and city planning commissions or airport district commissions. One of the chief functions of this state commission, through the local commissions or districts, would be the preservation and protection of areas for future airport use.

It would be well for every community to have a local public official, or a bureau, board, or commission, properly appointed and legally authorized to speak with authority on local airport facilities. The Los Angeles County Regional Planning Commission and the Orange County Planning Commission are excellent examples of such official bodies. Progress will be best made when airports are operated as an independent utility and on a business-like basis.

While the flying side of airport operations cannot be neglected, we must approach the problem of airport operations also from the standpoint of attracting public support for the non-flying activities to be found on our airports. The more income which can be derived from the people in dining, sightseeing, and so forth, at the airports, the less will be the burden on air carriers and private flying.

From the standpoint of a community most airports will pay for themsleves only indirectly. They are intangible assets and justify their existence in the same manner as highways, streets and parks.

During the past four years the Civil Aeronautics Administration has expended over $400,000,000 on a civil airport program, and it is now preparing special booklets on urban airport planning and small airport development to accentuate the needs of the non-expandable airport.

Post-War Power Boat To Inherit Benefits Of Wartime Progress

by E. G. MURRAY
Richardson Boat Co.

▪ Syracuse, Feb. 23

(*Excerpts from paper entitled "Previewing the Post-War Boat"*)

A YACHTSMAN may expect the following in his purchase of the post-war boat:

1. New materials such as plywood, molded and flat panels; laminated structural members; plastics; molded tempered or safety glass; new synthetic finishes; and new fabrics.

2. New methods of construction which will result in lower initial cost to the purchaser.

3. Modern styling of hull and cabin (through the utilization of new materials and methods).

4. New mechanical installations, including development of light-weight horizontally-opposed marine engines and light-weight high-speed diesels

Since the post-war boat will be one of modern streamlining, compound curves are bound to exist. However, this is no great obstacle to overcome when a hull may be molded, in whole or in part, of plywood.

A major advantage of a molded plywood hull is that from the boat builder's standpoint, it lends itself admirably to mass production. Also, since there is no shrinkage or expansion of wood, there is freedom from leaks and from unsightly seams and frequent refinishing.

A molded hull effects great savings in weight because of its stress-free laminated construction which gives strength through rigidity. By its use, framing characteristics of the hull may be changed so that stations may be fewer and longitudinal members may be reduced in size and quantity.

Another point in favor of a molded plywood hull is the ease in which repairing may be accomplished, should this be necessary.

The molding of plywood is not limited to hulls, since such units as decks, cabin sides, roof tops, canopy tops, control stands, motor boxes, seats and so forth may be molded too. Flat plywood panels are being used to great advantage in bulkheads, floorboards, and cabinet work.

Laminated structural members are now a possibility by the development of cold setting urea resins, although a better bonding of the laminates is obtained if the glue can be polymerized in a curing kiln. The most important of the hull structural members that may be laminated advantageously are stem, keel, skegs, stringers, transom, framing, cabin top and deck frames.

New Uses for Plastics Foreseen

The boating industry will find many new uses for plastics, especially for solid color molded parts for trim, handles, knobs, electric fixtures and extruded shapes. Thermoplastic tubing should find its way into post-war boats for piping of fresh water from storage tanks to the galley and wash basins. There should also be a definite saving in cost of labor and materials realized by its use.

We shall find many new waterproofed color impregnated fabrics that will be color-fast, weatherproof, and fire-resistant. Upholstery made up of rot-proof and mildew-proof fabrics will also be a boon.

Cabin selections for the standardized hull would be to the boat production line what the coupe or sedan body selections are to the automotive assembly line. These units would be complete, and would include such items as windshield, windows, insulation, wiring, and electrical fixtures. A definite saving in production costs that could be passed along to the purchaser would be to design units such as dinette, divan, galley, and so forth, to be interchangeable in whole or in part, in all models of standardized hulls.

Definite improvements may be expected in lighting of the cabin. Tubular units should brighten the living quarters aided by a smartly painted interior. Concealed lighting should put an end to the standardized practice of too much varnished mahogany, from which no light is reflected. Fluorescent units will also be available.

The cost of operating the post-war cruiser should show a decided decrease over pre-war cruiser costs because of new hull design, lighter hulls due to new materials and more efficient engine operation.

New controls should assist the purchaser of a cruiser to handle his craft efficiently and easily.

Ideal Steel Defined As That Which Serves Best and Costs Least

by H. B. KNOWLTON
International Harvester Co.

▪ 1944 National Tractor Meeting

(*Excerpts from paper entitled "Automotive Steels, Past, Present, and Future, from the Engineering Standpoint"*)

FROM the engineering standpoint the ideal steel for any given part is the one from which a serviceable part can be made at the lowest ultimate cost.

The first 40 years of this century was the period of development of satisfactory steels, that is, steels that would give, and have given, excellent performance in service. While it is true that progress has been made toward economy, the experience of the last four years has demonstrated that in many cases the greatest economy in alloy content consistent with satisfactory performance was not achieved prior to 1941.

The war years have constituted the period of development of alternate steels, that is, steels that would behave in production and in service as nearly like the old steels as possible, yet steels that are comparatively low in alloy content.

The future will probably bring a more critical and scientific study of individual parts to determine the properties that are actually needed to guarantee satisfactory service performance and to select the steels that will most economically meet these needs. These may be called ideal or economical steels.

The object of most steel specifications is to assure that the finished part has desirable properties. Some believe that steel should be specified on the basis of physical properties alone with no restrictions with regard to composition, grain size, or cleanliness. This would be logical if we knew just what physical properties would guarantee successful service performance, but with our present degree of knowledge, a more complete description of the steel is desirable.

Hardenability Test

Hardenability has been invaluable during the period of the development of alternate steels.

Most of the old SAE alloy steels were medium- and high-hardenability steels, and they gave satisfactory performance and service. Some of them had other useful properties, and it has not always been known whether such performance was due entirely to hardenability or to some other property.

When the present war came along it became necessary to conserve alloying elements and, consequently, to create a new series of alloy steels. There was no time to investigate whether the properties specified for millions of parts then in production were necessary or not. It was a problem of immediate substitution. The most logical move

[1] See "Tentative Hardenability Bands," Contributions to the Metallurgy of Steel-No. 11. Published by the SAE and AISI.

was to create steels that would behave as nearly as possible like the ones they replaced. This was accomplished by creating steels that had the same hardenability as the steels then in use. These were the NE steels.

While these steels may not be ideal, they have made possible the maintenance of war production. In a great majority of cases the NE steels have proved satisfactory for service. Only a few types have been reported unfavorably and have been abandoned.

About a year ago the SAE and AISI appointed a joint committee to make a survey of the hardenability of the most common types of automotive steels. This committee found that there is a very broad range of hardenability among different heats of steel that fall within the analysis limits for a single chemical specification. All types of steel studied showed these wide ranges of hardenability.

The SAE and AISI recently published a booklet announcing a tentative plan for the purchase of certain automotive steels on the basis of guaranteed hardenability ranges.[1] The maximum and minimum hardenability limits for each steel have been set so as to eliminate about 7% of the heats made, in accordance with present practice. Slightly greater latitude in chemical analysis is permitted so far as individual elements are concerned, but the total effect is a closer control over the properties of the steel.

The writer believes that the adoption of these specifications will go a long way toward the elimination of the small per cent of heats that have been responsible for the majority of trouble due to failure to heat-treat properly.

Economical or Ideal Steels

Little consideration is being given to cost under the present conditions, but it is a safe prediction that the time is coming when cost will be second only to successful performance. The ideal steel of the future will be the one from which successful finished parts can be produced at the lowest ultimate cost.

The period that we will enter at the conclusion of the war will probably be one of intensive research to determine the properties that are needed to guarantee successful performance of individual parts, and to select steels and methods of heat-treatment that will produce these properties at a minimum cost.

This will mean a critical study of individual parts to determine the actual stresses in localized areas. Stress-strain testing has been greatly improved in the last few years, but it is probably still in its infancy. More must be learned concerning the actual stresses encountered in service. A great deal more must be learned about what the properties of steel really are that are needed to withstand service stresses.

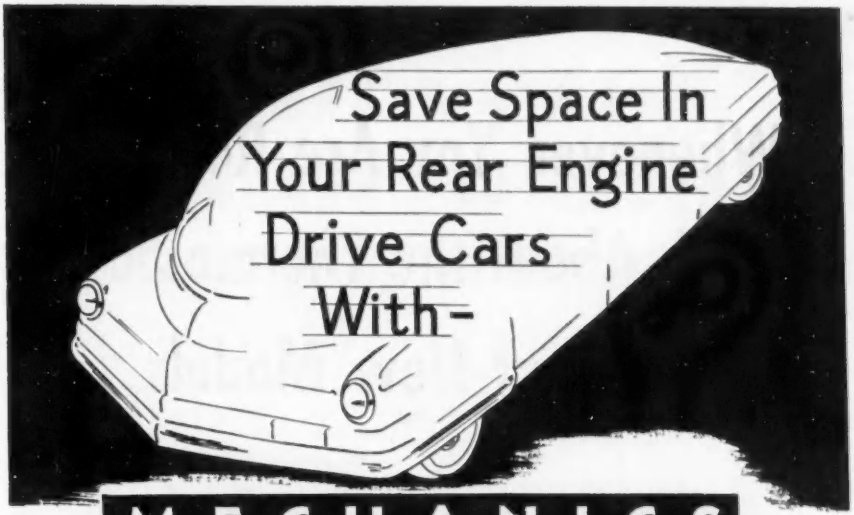
Conclusion

The specifications for automotive steels have grown up by trial and error, resulting in the use of a number of different families of steels, all of which have given satisfactory service performance. The experience of the war years has indicated that steels with lower alloy contents can satisfactorily be substituted on the basis of equivalent hardenability in most cases. Tests on gears and axles, however, have shown that there are other factors that should be given consideration.

The hardenability survey has shown that the range of hardenability for commercial steel is much wider, and the satisfactory minimum much lower than usually supposed. Future work should be devoted to the study of individual parts and types of parts to determine the stresses that are actually encountered and the minimum properties of steel required for successful performance. A thorough study should be made of internal stresses produced by heat-treatment and finally we should arrive at the most economical steels that will give satisfactory results in service.

Discussion

AN appeal for the standardization of steels and a reduction in the number of different specifications being used is most welcome, particularly at an SAE meeting, stated Roger F. Mather, Willys-Overland Motors, Inc. The automotive industry, he continued, is one of the last large industries still using the SAE rather than the AISI designations. In the majority of cases, the SAE and AISI specifications are now identical, and those differences that still remain are scheduled for gradual elimination. Enormous strides



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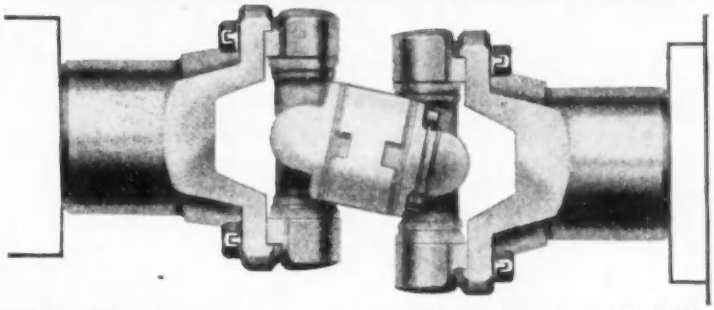

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have been taken during the war in the direction of standardizing steels, and they have helped considerably to increase production.

Certain special types of steels sold under brand names, Mr. Mather mentioned further, have not yet been included in SAE or AISI specifications. This applies particularly to nitriding and low-alloy, high-yield-strength steels, and to nonproductive steels, such as those used for tools, dies, and heat-treating equipment.

The purchase of heat-treating steels according to a wide chemical range and a relatively narrow hardenability range, Mr. Mather continued, is most promising. However, he felt that to omit the chemical specification entirely would be inadvisable, since then the forgeability and machinability would vary too much. Keeping within a reasonably wide chemical range also ensures uniform corrosion and low-temperature impact properties, although these are of relatively little importance in automotive applications. The prospects of using special addition agents, such as grainal and ferroboron, in conjunction with hardenability specifications for steel, is also attractive, particularly because the same hardenabilities may then be obtained with lesser amounts of alloying elements, so that the forgeability and machinability are improved.

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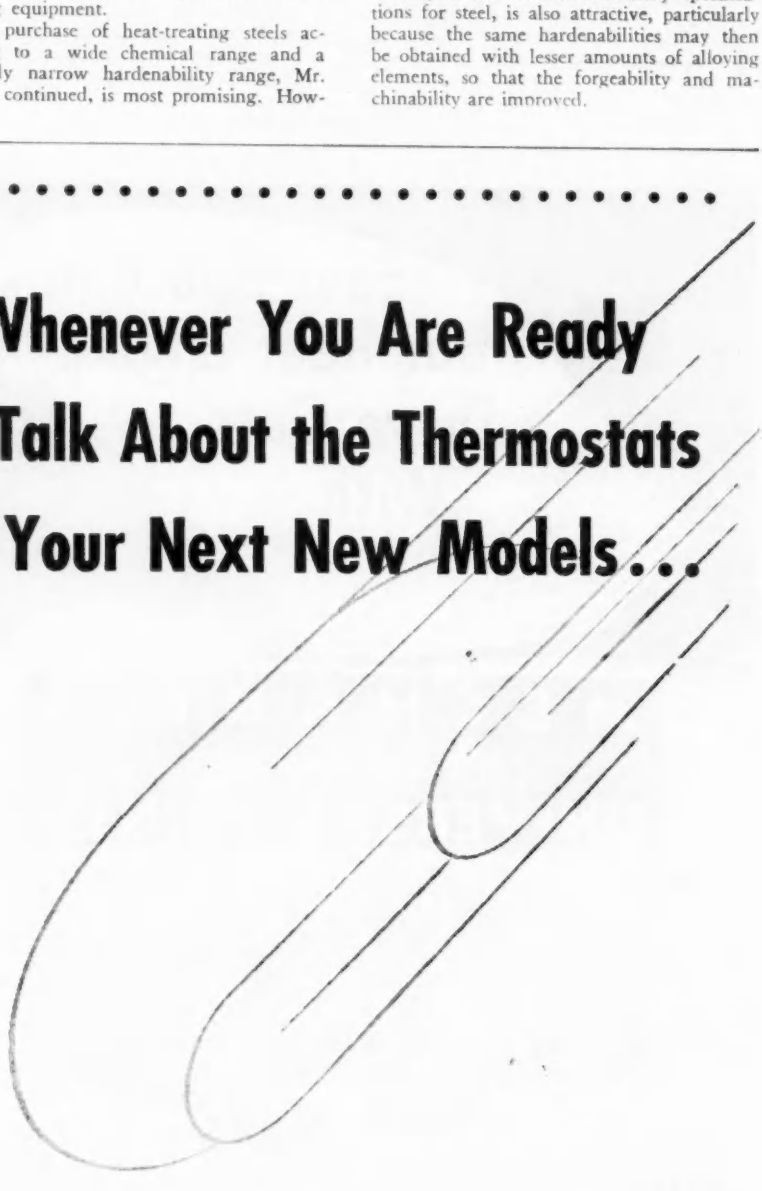

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Helicopters Invite Wartime Techniques

by MILLER A. WACHS
Sikorsky Aircraft Division

▪ **Southern New England, Feb. 7**

(*Excerpts from paper entitled "Building Utility into the Helicopter"*)

As we build helicopters for utility, serviceability and dependability, we will have to take advantage of every promising material in its composite construction. During the last several years, we have experimented with and used, among other materials, plastic impregnated glass fabric, magnesium sheet, new types of light soundproofing materials, and plastic impregnated wood.

As we build utility into helicopters, they will have to be made to last under conditions to which they are subjected. In this endeavor, we mean to do the following:

1. In order to prove the design, component test of transmissions, clutches, rotor heads will have to be carried out.
2. Stress will have to be measured on moving parts in flight.
3. Type tests or endurance tests will have to be made of complete aircraft.
4. Accelerated service flight tests simulating proving ground tests will have to be carried out.
5. Accelerated field service tests under actual operating conditions will have to be made.
6. Fundamental research will be necessary.

■ ■

Utilize High-Speed Movies in Research

by RICHARD PAINTER & PAUL HUBER
General Motors Proving Ground

▪ **1945 War Engineering-Annual Meeting**

(*Excerpts from paper entitled "Technique for Practical High-Speed Motion Pictures"*)

THE first really convenient commercially available high-speed motion picture camera was of the rotating-prism type, produced in 1933 by Eastman. This camera was rated at 2000 frames per sec, and the mechanism was combined with a tuning fork and synchronous timing device. In 1942 Western Electric started the manufacture of two models of high-speed motion

picture cameras which would go to much higher speed. The 8 mm camera was rated at 8000 frames per sec, while the 16 mm camera was rated at 4000 frames per sec. About a year later, Eastman offered a 16 mm camera which would reach 3000 frames per sec.

These two cameras, which have been of the rotating-prism type, have completely eliminated mechanical "bugs" within their rated speeds, and the greatest single problem remaining is the technique of providing and handling sufficient light.

The light source is from commercial sealed bulbs, GE PAR/SP-150, of the internally silvered spotlight type, and are operated at higher than normal voltage by means of a stepup transformer. If a 120 bulb is operated at 225 v, its light intensity has increased 10 times, while its life is about 1 hr. The result is a high-intensity light which allows the lens to be stopped down, with satisfactory overall life of the lighting equipment.

Closely connected with the problem of light is proper contrast in the subject. A light colored background is nearly always desirable. This may be accomplished by secondary lighting on the background, and may be greatly improved by use of a painter's drop cloth.

At the highest camera speeds, it is usual to concentrate the attention on such a small piece of mechanism that it is not at all difficult to light the background. Often the light spilling over on the surrounding parts of the machine being studied provides such a lighted background.

Painting Aids Contrast

Painting is a great aid in obtaining proper contrast. Where a picture must be taken in several places, it is desirable to use a relatively dull gray on the parts of the machine that are close to the camera and the lights. Parts further back in the machine are painted lighter, until at the back one can use a white. When this is lighted, it will clearly delineate the motion by avoiding over-exposure and halation due to too high contrast.

Brightness Meter Developed

The exposure time of a single frame is determined only by the speed of the camera. The only adjustments for the operator are the aperture of the lens and the camera speed. We have found that a brightness meter based on an optical wedge, with added density screens, is an excellent exposure meter. The brightness of the test area can be matched to that of the desired field for areas smaller than 1 sq in., so that it becomes easy to obtain the proper exposure on the desired area. If the background is comparable in size to the test area, its brightness should not be less than one-third that of the test area.

Camera speed is controlled simply by adjusting the input voltage to the motor. During any one exposure, the camera accelerates to nearly a constant speed for the duration of the exposure.

The speed at which the camera is to be operated on any particular shot is dependent on the speed of the operation one wishes to view. It is desirable to have the phenomenon under study require from 5 to 10 sec for projection on the screen. If the camera is operated at higher speeds than are required, the reproduced motion is so slow that the illusion of continuous motion is lost, while projection time much slower than 5 sec is undesirable. However, in many cases the speed giving a time of 5 to 10 sec should apply to the particular part of the cycle in which one is interested, rather than to the complete mechanical cycle.

Limitations Involved

There are certain limitations concerning the technique of operating high-speed motion picture cameras. First, most high-speed motion pictures will not have the snappy quality associated with good stills or movies, and in general the pictures are fuzzy and lack definition. Second, a large amount of accessory equipment must be used with these cameras. Third, a great amount of imagination must be used in order to photograph successfully an unseen action of a novel device.

The greatest single limitation of high-speed cameras at present is that their speed is too low. We would be delighted if we could buy a camera which would go to 20,000 frames per sec, instead of the present 8000.

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NATS Sets Operating Record

by CAPT. C. H. SCHILDHAUER, USNR
Office of the Chief of Naval Operations

■ 1944 National Air Cargo Meeting

(Excerpts from paper entitled "Naval Air Transport Service Experiences")

THE following figures tell the story of the Naval Air Transport Service accomplishments during the past few years:

Ton miles for July, 1943, had reached the totals for air of 6,107,966, only to continue to flow upward until by December this figure had reached the all-time high for a single air transport operation of 9,286,471 ton miles. September of this year, the total of ton miles was 22,120,699, while passenger miles flown went to 73,106,608, as cargo and mail ton miles reached the peak of 14,810,039.

A problem that NATS has had which should not confront ordinary air cargo operators is the one of weekly route changes. While commercial operators may establish fixed lines of operation, NATS cannot follow such a procedure. The continual shifting centers of war make it necessary to change all plans from planes to crews to operations. The burden of mail and wounded alone permits us little chance for a static set-up in our operation, as we must be close behind the progress of battle lines to can be considered reasonably safe.

We have found through our operations that there is no definite bracket that can be used to define air cargo. If a bracket need be used, it would best be thought of as the field of special service freight, and the air cargo operator of the future would set his operation up so that he would be prepared to handle anything the peak-load factor of his equipment could carry.

No matter how well defined in paper work, no operation can avoid the curse of all carriers, unscheduled delay. However, NATS has kept our aircraft utilization standards at levels consistent with good operation. A few figures concerning this are:

Transport design R4D –
9.4 hr per day – April, 1944
Current average, all R4D's –
7.0 hr per day
Transport design R5D –
8.9 hr per day – October, 1943
Current average, all R5D's –
6.0 hr per day
Combat design PB2Y-5R's –
9.4 hr per day – September, 1943
Current average, all PB2Y-5R's –
7.5 hr per day
Combat design PBM-3R's –
8.3 hr per day – May, 1944
Current average, all PBM's –
5.5, hr per day

We have already projected ourselves into the period beyond the date of peace by making full utilization of the Martin MARS, for example, which recently completed its first year of actual airline operation. This ship has opened up new possibilities as a gigantic carrier of tons of freight and mail as well as a passenger carrier.

We are seeing to it that our operations, no matter under what pressure of war, are still as close to regular airline operation as it is expediently possible to keep them. This is being done so that it will be possible to hand over whenever the terminal date of some of our operations arrives, a complete package consistent with practical and profitable airline operation.

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Military Transport Airline Operates as Proving Ground

by JAMES B. REA
Consolidated Vultee Aircraft Corp.

■ Kansas City, Nov. 1

(Excerpts from paper entitled "The Operation of Consairway by Convair Has Influenced Post-War Aircraft Design")

THE operation of Consairway as a military transport airline has provided Convair with its own proving ground with which to

test in long-range over-water air transportation the latest aircraft design improvements.

Operational advantages to Consairway resulting from its close association with the factory have been many; on the other hand, Convair has benefited by direct association with Consairway for the following reasons:

1. Convair has been able to check the flying ability of its airplanes under conditions analagous to those of commercial operation.

2. Flight-crew reactions to Convair airplanes have been directly reflected in design improvements.

3. Passenger reactions and their suggestions have been used to improve comfort design.

4. Service information on engines, propellers, and other equipment not manufactured by Convair, has been obtained from Consairway as a guide to future purchases and requirements.

5. Data on cruising speeds, ranges and fuel reserves which are required for many varied flight routes, have been supplied to Convair designers by Consairway.

6. Consairway has also supplied Convair with information on conditions which might be expected in different sections of the world that require specialized equipment to overcome service difficulties.

7. Flight charts, and additional operating data furnished flight crews, have been improved as a result of suggestions from Consairway operating personnel.

8. Consairway has supplied service information which has helped Convair reduce the time required for major overhaul on new designs.

9. Factors influencing the cost of airline operation have been brought to the attention of the designer.

In keeping with the policy of increasing the demand for post-war air transportation, design trends for commercial aircraft at Convair are based primarily on operational safety, high speed, comfort, and maximum investment rate of return to the airline operator.

Commercial airplanes should be compared on the basis of maximum rate of return to the airline operator rather than on the basis of minimum direct flying cost.

It is important that Civil Aeronautics Board establish post-war civil air regulations *today*, and not wait until tomorrow's commercial airplanes have been built.

It is also important that the C.A.B. help to establish and approve post-war revenue charges as soon as practical, because these charges will definitely affect the optimum choice of design factors to give a maximum investment rate of return to the airline operator.

The record of the over-water operation of land planes by Consairway has proved conclusively that landing at speeds considerably in excess of 80 mph are safe, especially when the tricycle landing gear is used, and when airport runways are long enough. Experience has also shown that operation economy and comfort are increased by use of high wing-loading. Thus, it is hoped that post-war C.A.B. regulations will be revised in the light of recent operational experience and proved safety records.

Lubrication Program Facilitates Maintenance

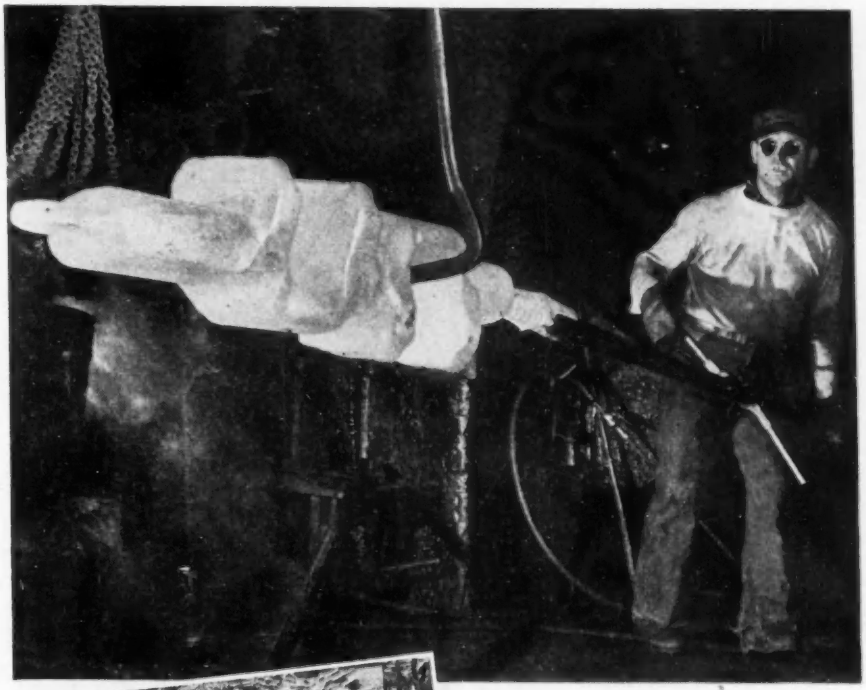
by E. P. GOHN
Atlantic Refining Co.

■ Cleveland, Feb. 12

(*Excerpts from paper entitled "Post-War Truck Selection and Conditioning"*)

PREVENTIVE maintenance or periodic inspection has as one of its chief aims the lubrication, inspection, adjustment or replacement of parts at certain operating periods. At present, failure of parts can become increasingly costly due to tying up the equipment for long periods until replacement parts can be obtained.

Advantages that result from having a good lubrication program are that, in addition to the lubrication itself, physical checks of many parts of the engine and chassis can be made by the well-trained lubricator while he is performing his normal duties. Also, at these lubrication and inspection periods,



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safety items are under scrutiny, such as loose or frayed wires, leaks in the fuel or cooling system, lighting system and switches, as well as proper functioning of steering, brakes and clutch.

The cooling system is without question one of the most important items of the automotive equipment for obtaining proper engine operation and efficiency. A neglect of this check-up leads to engine over-heating resulting in abnormal thermal distortion, burned valves, pistons and cylinders. Bad leaks, which are usually easily traced, are not so much a problem as slight leaks which go by unnoticed except when indicated by the necessity of adding liquid make-up at regular intervals. One of the significant points brought out during an investigation of this subject was that these slight leaks amounted to an average of 8 cc of water per mile per vehicle. From this we arrived at a figure of about a gallon loss for each 473 miles traveled. It has been advocated that a visible sight gage be made available so that the liquid height in the radiator can be checked.

Among the many headaches connected with the operation and maintenance of truck and bus equipment is cold weather operation, particularly that faced by operators in the northern section of the country. Experiments on cold starting showed that starting ability improved by the use of electric immersion heaters placed in the cooling water surrounding the cylinders.

One of the important phases of our maintenance organization is the operation of the engineering test group. In addition to the task of testing many of the parts and materials used in replacement or repairs, this group is assigned the job of obtaining factual information which will be used for improving maintenance practices.

An important tool in the hands of the engineering test group is a complete set of operating records. Besides serving as a source of information to the manager to ascertain in what condition his fleet may be, it is constantly also being used by the test group in analyzing its problems.

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■ ■

Army Subjects New Vehicles to Tough, Prolonged Testing

by MAJOR E. J. BOEBINGER
Aberdeen Proving Ground

■ **Philadelphia, Oct. 11**

(Excerpts from paper entitled "Testing of Automotive Equipment at Aberdeen Proving Ground")

THE first step in testing any vehicle at Aberdeen Proving Ground is to determine if it is in condition to operate and if the vehicle is complete.

In proceeding with the test program, it is desirable to have the center of gravity as close to the ground as possible and in the center of vehicles, which is highly important in connection with the bridging ability and general riding characteristics and performance. Another important feature is load distribution. If the stowage racks are such that all the equipment is carried on one side of the vehicle, then it naturally will not ride satisfactorily.

Another consideration on all vehicles is the ranges and areas of fire of the guns. On our medium tanks M3 with the gun mounted over the right sponson the gun had a total traverse of 30 deg, which greatly restricted the area of fire. On our M4 tanks, with the main weapon in the turret, the area of fire is 360 deg. There must be sufficient depression of guns on all tanks and tank destroyers, since they will be used for firing at distant objects when these vehicles are used in defilades behind the crest of the hill.

Another important item of military vehicles is security from observation. We try to keep the silhouette of the vehicle as low as possible. We must also check vehicles for noise level as well as for exhaust flames.

With global warfare, which we are now experiencing, it is necessary that our vehicles operate in extreme temperatures, either hot or cold. In the cold rooms at Aberdeen temperatures will go to —40 F, where we can simulate starting operations in cold climates. We can get a fair indication of the cooling ability of the vehicle by loading it by means of field dynamometers or absorption trailers, and measuring the temperatures under such loads to determine if the vehicles are sufficiently cooled. The best results may be obtained, however, by operating in high ambient temperatures or in a special dynamometer room with controlled temperatures.

We must also consider mechanical reliability on our vehicles. In order to prevent failures, we subject our vehicles to continuous operation and have designated a 14 hr period. We also subject them to endurance tests—on transport vehicles we operate 10,000 miles; on tracklaying vehicles we operate for 400 hr, or 4000 miles.

In the case of Ordnance vehicles, a representative of the Ordnance Department inspects and briefly tests each vehicle. In addition, production vehicles are given extended tests under conditions simulating conditions imposed in the field. This is called the extended control test, the purposes of which are to detect manufacturing discrepancies and design deficiencies.

Various components and auxiliary equipment must also be tested, such as air cleaners, tracks, suspensions, special gun equipment and mine exploders.

We have three basic problems in clearing mine fields: first is effectiveness; second is indestructibility; third is maneuverability. Many types of mechanical mine exploders have been devised which include such things as oil drums filled with concrete, on which spikes protrude from the circumference of the drums.

Of the several types of air cleaners in common use in commercial practice, only the oil bath type is currently used on military vehicles. Two distinct classes of air cleaners are now used: for all combat and other vehicles required to operate in the combat zone, there is the heavy-duty type air cleaner; for transport vehicles the so-called medium-duty type air cleaners are used.

Of the air cleaners which have been investigated, the oil bath type has the advantage of higher efficiency over a longer period of time with the lowest cost in engine performance. It has the disadvantage, however, of requiring a supply of oil for servicing, which sometimes exceeds the amount of oil required for lubrication of all parts of the vehicle.

In the design of present-day oil bath air cleaners, an attempt is made to provide as much self-washing action as possible. This is accomplished by designing the air passages to allow the circulation of oil through the filtering and condensing elements, oil being continuously returned to the oil pan, washing much of the dirt into the oil pan where it can settle out. Degree of self-washing action determines, more than any other factor, the amount of dirt which the air cleaner will hold without excessive increase in restriction.

Many variations of this dirt capacity test are possible, and it is known that the standard procedure now in use does not produce results in direct correlation with field operation. The standard test is operated at a constant airflow when constant airflow is probably never obtained in the field. The fine test of dust is used in the laboratory, whereas the dust usually encountered in the field is of much larger particle size. The air cleaner is practically without motion or vibration in the laboratory tests, whereas it is subjected to much motion and vibration when operating in the field. As a result, air cleaners operated in the field will generally hold more dirt before reaching 20 in. of water restriction than when operated on the laboratory test. We have been well aware of these conditions, and a laboratory dirt capacity test is being developed which has resulted in a number of different types of air cleaners holding about the same amount of dirt in the laboratory as they did in the field, with the dirt distributed within the cleaner in the same way. This revised test employs a uniform cycle of variation in airflow, a uniform cycle of variation of motion and vibration, and dust of somewhat larger particle size than the standard efficiency test of dust.

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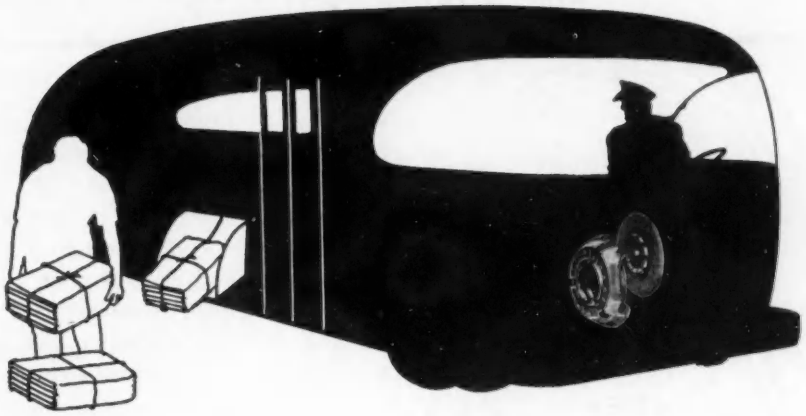

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NEW MEMBERS Qualified

These applicants who have qualified for admission to the Society have been welcomed into membership between March 10, 1945, and April 10, 1945.

The various grades of membership are indicated by: (M) Member; (A) Associate Member; (J) Junior; (Aff.) Affiliate Member; (SM) Service Member; (FM) Foreign Member.

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Indiana Section: Joseph H. Clark (M... Emory N. Kemler (M), Herbal A. Thom... burg (M).

Kansas City Section: August Bartsch... (A), Walter R. Loewen (A), Elmer Olso... (M), George C. Prill (J).

Metropolitan Section: Graham H. Bell... (J), Emil V. Belsky (A), William J. Bo... (J), Sydney Thomas Clifford (A), Jules R... Esser (J), Erich O. Fietsch (A), Dr. John O... Forster (M), Henry L. Gasbare (J), Wilfre... R. Grosser (M), Henning Karlby (M)... Irving F. Koetting (J), Wallace Mac Wi... liam (J), Jean William McComas (J), Leon... ard H. McPeek (A), Patrick J. Meade (A)... David S. Milligan (A), Louis John Schmidt... (A), Walter H. Skidmore (A), Frank J... Smith (A), Adolph Sokol (A), A. Theile... mann (M).

Mid-Continent Section: William Ken... neth Randall (J).

Milwaukee Section: Herbert N. Hartz... (A), John W. Henderson (A), Earle F... Rueter (M).

Mohawk-Hudson Group: David C... Prince (M).

New England Section: Walter T. De... vine (A), Thomas F. Kinahan (A), R... Clayton Meserve (A), Edwin I. Ofgant (A)...

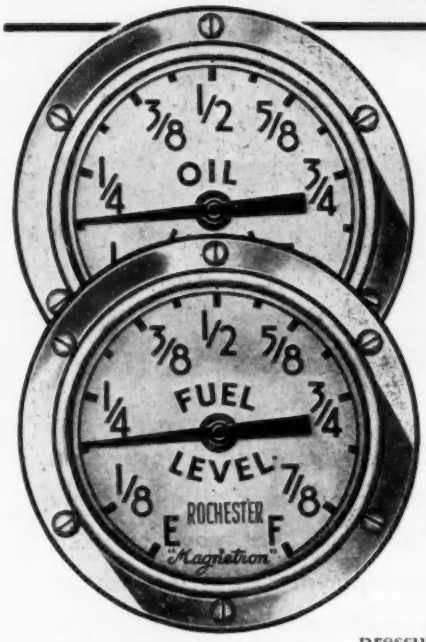
Northern California Section: Lt... Peter I. Brown (J), Lt. (jg) Thomas Francis... Burke (J), Lt. Wilhelm Sydow Everett... (SM), A. J. Larrecq (M), T. L. Meiss (A)... Robert H. Miller, Jr. (J).

Northwest Section: William A. Alex... ander (A), Wilbur Ward Betts (M), Lloyd... W. Dillingham (A), Edwin N. Grubbe (A)... C. C. Harwood (A), Merl F. Miller (A)... Harold S. Pelton (A), H. R. Pinkerton (A)...

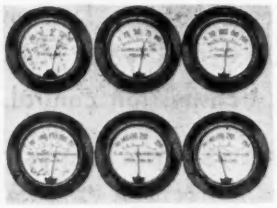
turn to p. 52

ROCHESTER DIESEL ENGINE GAUGES

constantly show lube and fuel oil level and engine operating conditions



There are Rochester Gauges with large dials for indicating the liquid level in fuel and lube oil day and storage tanks. They can be mounted on the top, side, end or bottom of the tanks. Quick and easy to read, they indicate at a glance the liquid level in the tank with no hazard of leakage even though the glass face should be broken. The action of the float is transmitted magnetically through a heavy forged brass head capable of withstanding thousands of pounds pressure if necessary.



Rochester Gauges for the indication of engine operating conditions, oil pressure, fuel pressure, water and lube oil temperatures, and ammeters are specifically designed for heavy duty service. New improved designs and techniques in manufacture, a result of our production of these gauges for combat equipment, have added further to their length of life under heavy duty conditions.

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FOR ACCURATE LIQUID-LEVEL, PRESSURE and TEMPERATURE INDICATION

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There are certain folks with Hyatt who won't believe anything they are told about a bearing. They have to *see for themselves!*

That's their job. It starts even before we get the steel from which the bearings are made. Hyatt metallurgists are right in the steel mills to see that specifications are met. It continues through the various steps of precision manufacture until the finished Hyatt Roller Bearing is finally assembled and shipped.

It isn't going to extremes to have so many men and women operators spending all of their time testing, inspecting, checking and rechecking Hyatt Roller Bearings. This sort of painstaking care is one of the things that makes a bearing good.

And it pays! For faultless bearings are essential to faultless operation—whether the application is for the machine that makes a bomber's crankshaft, or for the crankshaft after it's in the bomber.

Hyatt Roller Bearings have to "make good", so they have to be made good! That's why so many are used.

HYATT BEARINGS DIVISION • GENERAL MOTORS CORPORATION

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Oregon Section: Frank Costanzo (A), Earl Edward Geisler (A), J. H. Howell (A), Richard H. Hunger (J), Douglas D. Moore (A).

Peoria Group: Francis J. Rother (J).

Philadelphia Section: Frank N. Piasecki (J), Gordon K. Stebbins (J).

Pittsburgh Section: William J. McCahill (A).

St. Louis Section: Archie Knox Miller (M), Paul H. Van Osdol (M), Granville Avery Waters (M).

Southern California Section: John Michael Alder (A), Luther I. Blunt (J), James Henry Boatner (A), Richard C. Colyear (A), Howard E. Gray (A), Del F. Greenblatt (J), Henry G. Howell (J), Dwight Williams Huntington (M), R. J. Kerr (M), John S. Kohat (A), Howard D. Kurtz (A), Chas. H. Lynam (M), Leonard Mandell (J), Lewis E. Massie (A), Arthur F. Noyes (M), A. W. Talley (A).

Southern New England Section: Carl W. Bettcher (M), W. C. Robinson (M), George R. Sprague (J).

Southern Ohio Section: D. D. Brubaker (J), James Russell May (J).

Texas Section: J. F. Austin (A).

Twin City Group: Basil A. Beaver (M), Harry F. Wagner (A).

Washington Section: Farrand E. McIntyre (A).

Western Michigan Section: Ernest [illegible] Thompson (A).

Outside of Section Territory: W. [illegible] Carney (M), Continental Piston Ring [illegible] (Aff.), Reps: Ira C. Allstadt, Jr., W[illegible] Hansford Land. W. N. Donaldson (M), E[illegible] ward Donley (J), C. T. Evans, Jr. ([illegible] Ensign Earl Edward R. Jones (J), Ens[illegible] Harvey I. Kram (J), Lt. (jg) Howard [illegible] McJunkin (J), Lt. Webb Miller (SM), [illegible] Kermit Rice (A), Thomas Herbert Ran[illegible] Jr. (J).

Foreign: William Herscovitch (J), (Au[illegible] tralia); William McClimont (FM), (Sc[illegible] land); Lt.-Col. Ewen McEwen (FM[illegible] (England); Andrew Craig Miller (FM[illegible] (England); Janos Molnar (FM), (Austr[illegible] lia); Keith McKenzie Stearne (A), (So[illegible] Australia); Sydenham John Wheeler (FM[illegible] (Australia); Bernard Bradbury Wr[illegible] (FM), (England).

APPLICATIONS Received

The applications for membership received between March 10, 1945, and April 10, 1945, are listed below. The members of the Society are urged to send any pertinent information with regard to those listed which the Council should have for consideration prior to their election. It is requested that such communications from members be sent promptly.

Baltimore Section: Bertram W. Gore, Jr., Randolph Stewart Merritt.

Buffalo Section: Robert A. Wolf.

Canadian Section: Air Transport Board, Norman A. Eager, Leonard A. Richardson.

Chicago Section: Ray L. Carlson, Oliver L. Champion, Carson E. Dalton, William J. DuPilka, W. S. Faurot, George E. Franck, John J. Goodwillie, Woodrow A. Hasbany, Carl Hiltermann, John L. Lowe, Kenneth L. Mulholland, David R. Osborne, Jr., Thomas A. Russell.

Cincinnati Section: Bert S. Mellors.

Cleveland Section: Irwin A. Binder, Clinton H. Brown, Guy F. Chalfont, Howard N. Clark, Laurence H. Flora, Richard A. Hartman, Wilson Roy Heller, Robert J. Holton, Ernest R. Johnson, Bernard Madow, John A. Ryan, Robert M. Shaw, Robert B. Wick, James E. Wise.

Colorado Group: William P. Akers.

Detroit Section: Frank E. Davidson, Walter H. Hedley, Capt. Donald B. Hooser, Stephen Charles Islander, Wilfred L. Kenyon, Charles Harry Phillips, Robert P. Powers, William J. Resch, Henry S. Walker, Roy F. Weeks.

Indiana Section: William H. Crouse, Stanley Sundling.

Kansas City Section: Andrew Douglas Murphy.

Metropolitan Section: Robert D. Barry, Moritz Bierling, Harrison H. Bopp, Alan Raymond Collins, Benjamin B. duPont, David J. Fraade, Chris J. Frey, Ezra Grossman, Edward Guzeko, Moses M. Jeydel, Daniel P. Hurley, Jr., Sanford Karon, Gunnar B. G. Larsson, Elwin F. Lindsley, John H. Middlekamp, Philip M. Peterson, Edward L. Portley, Blake Reynolds, Lee Webster Selfe, William Stephen Tandler, Richard H. Vogelmann, David S. Walker.

Mid-Continent Section: Sid N. Daily, Alan D. Morton.

Milwaukee Section: E. J. Biever, William J. Burke, Jr., Lt. Daniel Henry Hudson, Lt. Wilson B. Riggan.

Mohawk-Hudson Group: Charles Godlove.

New England Section: Edward J. Fischel.

Northern California Section: Ensign Robert Laurance Bennett, Herman J. Bihler, Harold Frank Doty, George Horace Hammond, Major Lawrence C. Ives, Patrick Martin Morrow, Earl J. Portz, Jackson R. Stalder, Orley R. Stephenson, George Elvin Willett.

Northwest Section: William R. Anable, Leonard W. Kowalsky, Russell B. Larson, Leo C. Nelson, Charles A. Seiler, Kenneth A. Short.

Oregon Section: Stanley F. Patyrak.

Peoria Section: Arthur E. Lux.

Philadelphia Section: George S. Garrard, E. Robert Kinnebrew, Ensign Russell W. Rand, Oliver E. Rodgers.

Pittsburgh Section: William J. Cappe, E. H. Kanarr, Charles Roberts, Otto Walter.

Salt Lake City Group: William [illegible] Clyde, Stanley A. Gudmundsen.

Southern California Section: Vic[illegible] P. Barton, John R. Brinkman, Paul [illegible] Browne, Jr., Howard B. Chamberlain, Rob[illegible] ert C. Crabb, Gordon V. Christy, Ted H[illegible] Davies, Hugh H. Eidt, Charles L. Ferna[illegible] John Elwood Frazer, Major Edwin Ha[illegible] Graham, Leon L. Graham, Ralph T. Gre[illegible] Edgar A. Griswold, T. F. Harms, John [illegible] Lyons, Robert R. Maynard, Richard [illegible] Seares, Tjerck Pope Shaw, Galen A. Sku[illegible] Justin H. Smith, Edward E. Stabile, Carl [illegible] Strid, Josiah T. Watts, H. E. Winn, Robe[illegible] J. Wright, Robert B. Young.

Southern New England Section: Joseph A. Brosseau, Wilbur Lucius Cro[illegible] Jr.

Southern Ohio Section: Major Arno[illegible] D. Dircksen, Reber C. Stupp, Roger H[illegible] Walton, Alfred C. Whiskin.

Spokane Group: Glen G. Hays, Georg[illegible] F. Hughes, Loring Harvey Meacham, Fra[illegible] A. White.

Syracuse Section: Donald Charles Ap[illegible] pelby, Frank B. Chadwick.

Texas Section: Fred W. Surber, Mur[illegible] son Henry Tix.

Washington Section: Lt.-Com. Fred[illegible] erick R. Bolton, Melville Lawson Brown[illegible] Albert Ladousse, Hugh J. P. McKane, Kwok[illegible] Wan Yip.

Wichita Section: Dean E. Burleigh.

Outside of Section Territory: John[illegible] William Barker, John Bryant, R. G. DeL[illegible] Mater, George W. Estes, Frederick J. Hanse[illegible] lek, Henry A. Lotz, Kenneth E. Mulvan[illegible] Ordnance Steel Foundry Co., William Colli[illegible] Spouse, Horace D. Taylor, J. T. Teagarden.

Foreign: Arthur William Bird, England; Albert Edward Hope, England; John Reg[illegible] nald James Mansbridge, England; George Henry Olding, Australia; Edward Francis Perry, England; Frank Shaw, England; Glynnden Jack Sinclair, Australia; Cyril James Tafft, England; Walter Raymond Turner, England; William Archibald Wil[illegible] son, England.

About SAE Members

cont. from p. 31

Formerly at Northwestern University, **SYDNEY J. SCHAID** is now an ensign in the U. S. Naval Reserve and may be reached at the Naval Training School, Cornell University, Ithaca, N. Y.

SYLVAN E. CONNAIR, JR., who had been at Purdue University, is an apprentice seaman in the Naval Reserve and is now studying as a member of the Naval V-12 group.

CLIFFORD F. SALOW, formerly instructor of inspection, Lord Mfg. Co., Erie, Pa., is now assistant supervisor of inspection, same company.

Formerly a second lieutenant, **VINCENT BONINA** has been promoted to the rank of first lieutenant and has been transferred from Amarillo, Tex., to B. P. O. 7, Lowry Field, Colo.

C. J. LIVINGSTONE, U. S. Naval Reserve, Room 2426, Temporary Building B, Washington, D. C., has been promoted from lieutenant commander to commander. He is a past-chairman of the SAE Pittsburgh Section.

Previously assistant to the vice-president, manufacturing, Shell Oil Co., Inc., New York, **T. B. RENDEL** has been appointed technical assistant, central aviation department, same company. Mr. Rendel is a past-chairman of the SAE St. Louis Section.

PAUL E. HOVGARD has been appointed associate director of the research laboratory, Airplane Division, Curtiss-Wright Corp., Buffalo, N. Y. He served previously as director of flight test for the division. In his new capacity, Mr. Hovgard will be associated with **DR. C. C. FURNAS,** research laboratory director, in aerodynamic engineering, structures, flight test, and other experimentation.

An ensign in the U. S. Navy, **RAY MELIN KOLB** has been transferred from Fleet Air, West Coast, San Diego, Calif., to Fleet Post Office, San Francisco, Calif.

CLIFFORD M. HELLER has severed his connection as chief engineer of development and production, Bingham Stamping Co., Toledo, Ohio, and is now employed at the Corning Glass Works, manufacturing department, Corning, N. Y.

BENJAMIN B. CRAVENS has recently been appointed assistant plant manager of the Waymoth Corp., Pawtucket, R. I. He was formerly management engineer, Aviation Division, Corrigan, Osburne & Wells, Inc., New York City.

ROBERT L. HARTLEY, who was formerly in the experimental engineering department, Narragansett Machine Co., Providence, R. I., is now experimental engineer, Fuel Injection Division, Bulova Watch Co., Woodside, L. I., N. Y.

Formerly stationed at the California Institute of Technology, **RAYMOND BRUCE FURST,** who is a midshipman in the U. S. Navy, may now be contacted at Fort Schuyler, N. Y.

Formerly junior test engineer, Wright Aeronautical Corp., Paterson, N. J., **C. TUMAN** is now serving in the U. S. Army and may be reached at Camp Gordon, Ga.

WALTER R. DERLACKI, an apprentice seaman in the U. S. Navy, formerly a member of the V-12 group, may now be contacted at U. S. S. Prairie State, New York City.

Formerly chief engineer, Northern Sas-

1/2 Mile MORE per Gallon with MOTO-MIRROR Testing

CLAYTON MOTO-MIRROR DYNAMOMETERS **have increased gasoline mileage, greatly reduced road delays, improved maintenance standards and saved critical man-hours for Baltimore Transit Company and other bus and truck fleet operators.**

The MOTO-MIRROR measures the power output of automobiles under actual load conditions. It makes performance testing—with engineering accuracy—easy and practical for all service shops. Experience has proved there is no better way to inspect, check or diagnose mechanical troubles than to measure performance under actual road conditions.

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FLEET OWNERS • Because they accomplish savings in critical parts and man-hours, a limited number of MOTO-MIRROR Chassis Dynamometers have been authorized for fleet operators. For complete information, please ask for Catalog 61

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ANOTHER EXAMPLE OF *YOUNG* ENGINEERING SERVICE

The LeRoi Company (Milwaukee, Wis.) selects Young Radiators and Intercoolers for their huge Portable Air Compressors.

WHERE *use* borders on *abuse* . . . where the heat of compression as well as the heat of combustion must be dissipated . . . there you will find Young *heavy duty* Heat Transfer Equipment doing *double duty*. In the tough assignments of the rugged compressors above, Young Radiators maintain uniform engine temperatures in spite of highly variable heat range due to alternate idling and full load of compressor motors. Specially designed Young After-Coolers for single stage compressors—and Young Inter-Coolers for double stage compressors—effectively discharge both heat and condensation. While there are many standard Young units adaptable to engine jacket liquid, lube oil and similar cooling assignments, special radiators can readily be built to your needs. Consulting Young Heat Transfer Specialists costs nothing—can save much.

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Oil Coolers • Gas, Gasoline, Diesel Engine Cooling Radiators • Intercoolers • Heat Exchangers • Engine Jacket Water Coolers • Unit Heaters • Convectors • Condensers • Evaporators • Air Conditioning Units • Heating Coils • Cooling Coils • and a Complete Line of Aircraft Heat Transfer Equipment.

YOUNG RADIATOR COMPANY, Dept. 315-E, RACINE, WISCONSIN, U.S.A.

katchewan Flying Training Scho... katchewan, Canada, **HECTOR W.** ... **CIS,** U. S. Army Air Forces, is now ... administrator, Edmonton, Alberta, ...

FRED E. MOSKOVICS, who is ... consultant with A. O. Smith Co... transferred his headquarters from ... kee to New York. He will be l... the New York office of the comp... West 44 St. Mr. Moskovics had ... been technical adviser to the A... Forces.

Previously assistant chief, Wheel... cle Section, Engineering Branch, U. ... Office Chief of Ordnance – Detroi... **MORRISON** is now located at ... Service, A. P. O. 887, Postmaster, N... City.

Formerly assistant service manag... Philadelphia Buick Co., Inc., Phil... Pa., **HARRY D. BLACKBURN** ... civilian employee of the Arabian-... Oil Co., and may be reached at ... 816, c/o Postmaster, New York C...

Formerly a student at Genera... Institute of Technology, Flint, **HUSTON G. WELCH** is now a ... the U. S. Army, and is stationed ... Monmouth, N. J.

JOHN H. AST has recently beco... nected with Joshua Hendy Iron ... Sunnyvale, Calif., as junior engin... Ast was formerly a student at the ... sity of California.

JAMES E. GONZALES has left ... servation engineering department ... heed Aircraft Corp., Burbank, Cali... he had been working on engineeri... lems relating to fabrication and ... of aircraft parts, and is now servi... technical department of customer ... the same company as liaison engi... tween the technical and production ... ments.

GEORGE K. STEPHENSON, a... in the U. S. Naval Reserve, has be... ferred from Port Hueneme, Calif., ... Post Office, San Francisco.

ALVIN B. COPELAND, who ... merly been customer engineer for ... Products Division, Bendix Aviatio... South Bend, Ind., is now project ... same company.

Formerly experimental engineer ... tional Broach & Machine Co., ... **REEVE R. HASTINGS,** now holds ... tion of sales engineer with the sam... pany.

JOSEPH GESCHELIN, Detroit ... Chilton Publications, will address ... nual conference of district engineers ... Clark Trucktractor Co., Battle Creek, ... on May 7. The general subject of ... concerns the post-war market for ... tive products as well as engineer... production developments in the offi... Geschelin is chairman of the SAE ... tion Activity Meetings Committee.

Formerly in the package engineer... service department of Somervill... Windsor, Ont., Canada, **GEORGE** ... is now in the war contracts and ser... partment and may be reached at t... office of the company at London, O...

EDUARD C. PETRY is now e... with Ranger Aircraft Engines, Div... Fairchild Aircraft & Engine Corp., ... dale, N. Y., as project engineer. ... been supervisor of fuels and lubric... gineering research, Armour Researc... dation, Chicago.

GEORGE T. HAMMERSHAIMB ... cently joined the Baldwin Loc... Works, Philadelphia, Pa., where he ... ployed as development engineer.